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CAN THE APPLICATION OF A LANDSCAPE DESIGNED LEARNING ENVIRONMENT ENHANCE EDUCATION?

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ABSTRACT

There is a need for a restructuring the way that a child's learning environment is designed. Currently, the mainstream educational design process ignores the notion that children have different ways of learning. Furthermore, when there are so many distractions, how we successfully reach a child's mind has become a challenge. The current school system is structured in a manner that does not address the presence of these distractions, often causing overstimulation and inattentiveness. Designing for children should be approached in a way that all senses are engaged. Having opportunities for hands-on learning inside and outside of the classroom is important and how we design learning environments needs to be closely examined to see how these environments work as a system that fosters learning. Much research has been done on the effect that nature has on child development, but this research is often lost when it comes to calculating measurements of success within the public school system. Many schools are beginning to use gardens as a way to create direct connections with issues that are important such as sustainability, environmentalism, and global awareness. Including these issues in curriculum and the design of learning environments is an excellent way to expose children to issues that directly affect the society. Education is not a one-dimensional idea. There are many factors and variables that should be addressed when preparing a comprehensive plan for a child's education. The design of a learning environment needs to be multi-participatory and include students, parents, teachers, administration, and any other outside support that has a connection directly or indirectly with a child's education. After extensive research in the form of observation; surveys of parents, students,

teachers, and administration; and case studies of schools that are using alternative learning environments, this study presents design guidelines and strategies to be utilized within the learning environment design application.

ACKNOWLEDGMENTS

This thesis would not have been possible without the guidance and support of my committee chair advisor and professor, Dr. Matthew Powers. I would like to thank him for his countless amount of hours of input and assistance that helped bring this thesis to fruition.

I also owe my deepest gratitude to my parents, family and friends for helping me to believe in my abilities and myself all while giving me moral support all along the way.

Thank you Jarrod Duncan for having patience during this process and lending me your days to help build the Dacusville Middle School math garden sometimes even after working all night. You are an amazing person and my best friend.

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CHAPTER ONE

INTRODUCTION

Background

There is a problem with an educational system when it does not foster learning. Too often, children are trying to learn in an environment that is unappealing to them and with teaching styles that are not stimulating their minds. Teaching children in an environment where there is exposure to nature and with teaching styles that relate to this space could have a positive affect on their learning.

To design a successful learning environment, one must understand and evaluate the many styles and methods of learning. The research in this study focuses on two methods of teaching: problem based learning and experiential learning, and how they have a positive effect on a students learning in an outdoor environment. This research will also evaluate the many learning methods and techniques that compliment and contribute to a successful learning environment.

This study also investigates the role of nature within the environment and within the curriculum, including the effect on the student's ability to learn. There is a considerable amount of scholarly research suggesting that nature-based learning serves as a positive method of education. In an a 2007 review of schoolyards by the United Kingdom based charity, *Learning Through Landscapes*, children reported that outdoor lessons are generally more interesting, varied and relaxed, that practical lessons are easier to understand, and that teachers are more friendly outdoors. Young children have an innate natural fascination with nature. By students to move beyond the confines of the indoor

classroom, teachers are giving the student a responsibility of their trust, which in return will build confidence in their abilities and enhance the sense of ownership of not only the actual learning space, but also the option to learn outdoors. This option to learn outdoors will become a place where children are able to learn understanding and respect for each other, their community and their environment.

Adding the element of play into this study will also enhance the design of an outdoor learning environment. Play is often overlooked as an essential part of learning, but it is through play that children learn about themselves and their surroundings. Teachers also can learn more about their students and their learning styles by watching how they play. This study will include play within its outdoor learning environment design through the use of the principles from the *Theory of Loose Parts*, by architect Nicholson Simon. This is a theory that supports creative play through the use of variable natural and synthetic materials that are integrated in the play space and creatively used by the child. Creative play, especially in outdoor environments, help students develop a deeper understanding and appreciation of nature, which in turn, lead to the care and protection of the natural world. By integrating creative play in an outdoor environment you create learning in a child that has a lasting effect.

Another important element of a successful outdoor learning environment that this study will focus its research on is the use of participation in the design process. By allowing a child's perspective to be heard, a gateway of understanding develops between the teacher and the student. Adults might be able to make sense of many of the viewpoints that occur by the children on a daily basis within their indoor classrooms.

Participation also allows for the child to take ownership in the space being designed for them. With ownership, a sense of responsibility and stewardship of the space is being developed. Consequently, the learning environment is one that is revered and maintained by the students, teachers, and all other users of the space.

The research presented in this study will create a framework of knowledge as the basis of its support. This supporting research will attempt to disseminate the question of why children are unable to learn by evaluating the learning environment of school and its relationship with the outdoor environment. It will also evaluate the use of play with respect to learning and how the incorporation of participation in the design process can create a successful outdoor learning environment for children. This information is critical to this study because children will spend a large amount of their time in academic spaces in which they will have no control. It is important that the education environment is one that will promote and stimulate a child's ability to absorb and retain information.

Significance

Children are the foundation of our future and how they develop is a critical reflection of our society as a whole. Currently, many public schools are below educational standards and the children are the ones who suffer the consequences of our educational system's failures. The cost of not knowing how to solve this problem is tremendous. When an outdoor learning environment is paired with an experiential and problem based learning style in an outdoor classroom that has been designed with participation, the results are a profound and deep learning that translates into not only better test scores, but also skills that will last a lifetime.

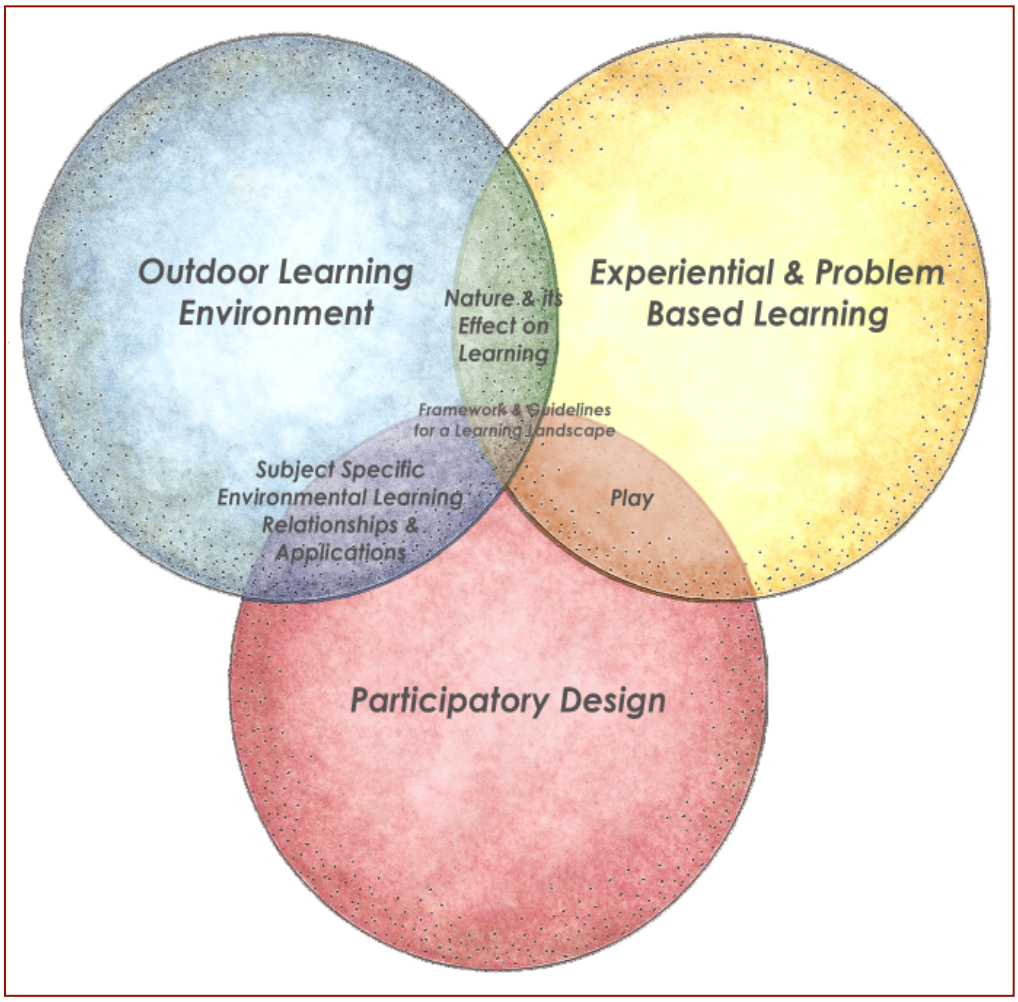


Figure 1-1 *Bodies of knowledge*

Framework, Scope, and Goals of an Outdoor Classroom Design

There are many problems within our educational system economically, socially, and physical issues affecting a child's learning that this study does not have the time to address. There are also many other avenues of teaching methods and alternatives that successfully foster learning. Given the brief amount of time to research and measure the study's results, it was necessary to narrow the design framework to learning styles as they

relate to the outdoor classroom. To properly evaluate whether an outdoor learning environment is a productive for a child's healthy development, a longitudinal study must be executed with an extenuating amount of data collection and analysis. This study will not have the extended amount of time that is needed to properly test the outcome of the proposed solution. However, this study will be able to help set up the learning environment for testing and give these tools of measuring success to the school itself so that they may monitor the students growth from the initial introduction at grade 6 to high school. The school will also attempt to set up ways to track students' success after leaving middle school to add to future data on its success. The goal of my research is to focus on presenting new alternatives to a successful learning environment.

Research Questions and Road Map of this Study

The following research questions were formulated to address the framework, scope and goals of designing a successful outdoor learning environment:

*Research Question 1***:** *What is the learning relationship between the indoor and the outdoor experience for children in school?*

Research Question 2: *What is the best method/route to design a learning environment so that children can fully understand and apply the information being presented to them?*

*Research Question 3***:** *What are the benefits of using different models of learning such as "hands-on" (experiential) and nature-based learning?*

*Research Question 4***:** *How can subject specific standards inform the design of an outdoor learning space?*

Research Question 5: *How can having student participation impact the overall design and learning experience?*

Research Question 6: *How can we test the effectiveness of the outdoor learning environment?*

In the following literature review and methodology sections, the scope and questions will be explored in the context of scholarly backed research supporting the use of outdoor spaces for learning and the observations of precedent studies where outdoor spaces are successfully used in the learning environment. This study consists of a literature review on learning environments that including:

1. Specific learning styles and techniques that foster learning in an outdoor classroom.
2. The effects of nature on learning and the positive role that play has in the learning process.
3. And the outdoor learning environment and the important role of active participation by all users in its design, development, and construction.

Several case studies from around the world will be examined and define what made their outdoor school learning environments work. From these areas of knowledge and case studies, a set of guidelines will be created that will essentially "guide" the design of an outdoor learning environment at a public middle school. With the help of students, the design will be installed and with the assistance of the middle school the learning effects will be observed and tested on the students learning longitudinally from inception to the end of the school year.

CHAPTER TWO

LITERATURE REVIEW

Chapter Organization

This chapter presents a review of literature that is organized into five sections. The first section provides an introduction to the different methods of learning applicable to an outdoor learning environment. In the second and third sections, the incorporation of nature and outdoor play in the learning environment is discussed to set the foundation for this study. In the fourth section, the importance of participation in the design is noted in the success of the outdoor learning environment. Finally, a synthesis of the literature concludes this chapter.

Methods of Learning: Experiential and Problem Based Learning

It is important to recognize that there are many theories of learning and each student has their own individual learning style. These styles indicate the characteristic strengths and preferences in the ways they process information. Some students tend to focus on facts, data, and algorithms; others are more comfortable with theories and mathematical models. Some respond strongly to visual forms of information, like pictures, diagrams, and schematics; others get more from verbal forms—written and spoken explanations. Some prefer to learn actively and interactively; others function more introspectively and individually (Felder 1996).

It's also important to evaluate the use of learning styles and techniques in context with our changing world. Today we need collaboration, not lectures. We need to learn concepts, not single facts. We need networking and socialization, not isolation. We need

interactive learning, not to sit back and listen. We need new outcome objectives, not standardized tests ("RSA Animate – Changing Education Paradigms" 2010). The learning environment is just as important as the method of delivery. There are schools around the world that devote their educational vision to issues that are both mainstream and educational. There are many private schools within the United States that have programs that are tailored around specific ideals and principles, such as sustainability. These are fundamental concepts and ideas that are directly related to issues that are occurring within society. We know that children make connections through application and in the process they learn and retain the information, but what is often missed is how this has the ability to translate over into every day life.

Experiential Learning (Hands-on Learning)

In order to engage, we must determine how a child can effectively learn by evaluating their learning styles. When children make connections from curriculum lessons to real-life application they are instilled with a sense of a deeper understanding, which they will then be able to take pride in spreading the ideas that they learn and as a result become educators, themselves. This type of application is not something that can be learned and applied through reading a book. It is done through the power of "doing". It requires a child to physically remove themselves from behind the computers and television screens and actively engage in the world that is happening around them. Under the motivational and humanist theories lies the experiential learning model by David A. Kolb. This learning theory is a holistic perspective that combines experience, perception, cognition, and behavior. Building upon earlier work by John Dewey and Kurt Levin, Kolb believes

"learning is the process whereby knowledge is created through transformation of experience" (Kolb 1984, 38). Experiential Learning occurs when carefully chosen experiences are supported by reflection, critical analysis, and synthesis. Kolb's theory is often depicted in a four-stage learning cycle.

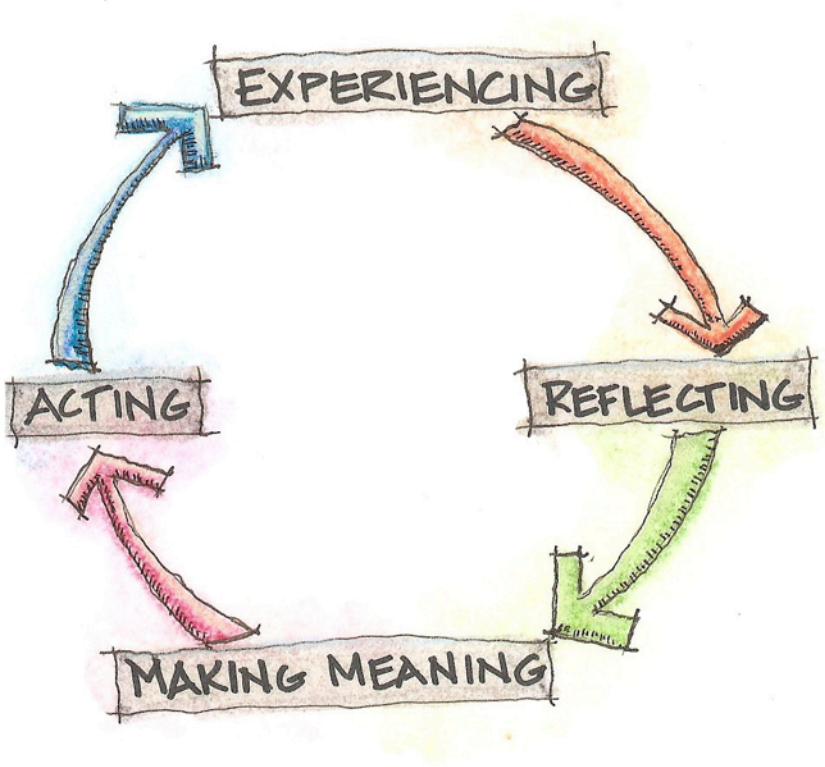


Figure 2-1 *Kolb's 4 part learning cycle that gives the student or participant the opportunity to use all or a combination of learning styles to better process and retain information.*

Kolb further identified four learning styles that correspond to the four different cycles of learning. These are: assimilators (learn better with sound logic), convergers (learn better with practical application of concepts and theories), accommodators (learn better with "hands-on" experiences), and divergers (learn better when allowed to collect a wider

range of information). In an outdoor learning environment, a student has the opportunity to use all or a combination of these four learning styles.

Problem Based Learning

Problem Based Learning is student-centered learning where learning for the student takes place within the contexts of authentic tasks, issues, and problems--that are aligned with real-world concerns. In Matthew N. Powers's PhD dissertation from Virginia Polytechnic Institute and State University entitled, "*A Study of Self-Regulated Learning in Landscape Architecture Design Studios*" he stated that problem based learning teaches a student problem solving skills and applied knowledge by embedding learning in the process of solving an authentic problem within a professional setting (quoted in Albanese, M.A., and Mitchell 1993, 52-61).

Taking Learning Outdoors

The problem of overstimulation and inattentiveness is an issue that stems from a lack of outdoor interaction. Learning taught in lessons outdoors help pupil motivation and understanding and encourage an atmosphere collaboration between pupils and teachers, which helps children develop their interpersonal skills... Lessons outdoors also offer more opportunities to use different teaching and learning styles, particularly problem solving and group work, which enhances pupil's self-esteem and self-confidence ("Ground Notes: Outdoors math" 2008). The students do not have the ability to choose where they can learn, but a teacher does. When a teacher expands the walls of his or her classroom to the outdoors, they open up a completely new perspective of learning for the student. The inside environment is more than a room with arrangements of furniture or collections

of decorated curriculum areas, and the outside environment is more than swing, slide, and sand area. A teacher can be more than the arranger and maintainer of the environment (Stine 1997, 6). As evidenced in child-nature studies, there are clear connections between experiential, natural play and impacts on cognitive development in such environments (Miller 2010, 19). Beyond attention studies, Wells and Evans (2003) found that rural children with more nature (i.e. green views, grass rather than concrete yard, plants) near their home scored lower on maternal ratings of anxiety, depression, and behavioral disorders (Miller, 2010, 21). Research supports the idea that nature is essential to the physical, psychological and social well being of a child's optimal development. There is compelling evidence for a link between green space and enhanced capacity to pay attention in children. The link appears to hold when comparing different children's attention functioning in, and after being in different settings (Spencer and Blades 2006, 129). This research shows that children are more creative and have better learning curves in green spaces than in built spaces. Ruth Wilson stated in her book, "*Nature and Young Children,*" that the basic idea of environment-based education is to use the surrounding community, including nature, as the preferred classroom. This approach has proven effective- not only in fostering the naturalistic intelligence but also improving the academic performance (quoted in Louv 2006, 204; Sobel, 2004).

The Role of Play in the Learning Environment

Another important factor in a child's learning process is the inclusion of play. Children are more cooperative, happier, healthier, and able to learn better when they have frequent and varied opportunities for free and unobstructed play in the outdoor

environment. Through play, children (and bigger people, too) learn a great deal about the variety and complexity of the world, and about themselves as self-directed learners (Jones and Prescott 1978, 1). Positive child development requires a social, high-quality physical setting where natural learning and motivation through play is woven into the fabric of the formal curriculum. Play is critical to socialization and is the primary way in which children relate to one another and make sense of their surroundings (Moore and Wong 1997). By integrating play in an outdoor environment you create learning in a child that has a lasting effect.

The *Theory of Loose Parts* is a theory that supports creative play through the use of variable natural and synthetic materials that are integrated in the play space and creatively used by the child. "Loose parts" was a term that was originally coined by architect, Simon Nicholson in the early 1970's. When developing this theory, Nicholson took into consideration and evaluated different environments that form connections. The theory is supported by numerous studies comparing schoolyards filled with blacktop playgrounds to schools that use natural play areas. Nicholson stated that, "In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it" (Nicholson 1968). Nicholson believed that we are all creative and that "loose parts" will empower our creativity ("Loose Parts: What does this mean?" 2007). The idea of the loose parts theory is that kids are creative by nature and when they have an available array of physical variables, their imaginations will flourish in play and exploration. The result of this creative play can be seen in active learning. There is evidence that all children love

to interact with variables, such as materials and shapes; smells and other physical phenomena, such as electricity, magnetism and gravity; media such as gases and fluids; sounds, music, motion; chemical interactions, cooking and fire; and other humans, and animals, plants, words, concepts and ideas. With all these things all children love to play, experiment discover and invent and have fun (Nicholson 1972). A "loose-parts" toy as Nicholson defined it, is open-ended; children may use it in many ways and combine it with other loose parts through imagination and creativity (Louv 2008, 109). Loose parts can be used alone or in conjunction with other materials. They can be natural or synthetic. The possibilities of loose parts are only limited by the child's imagination. Loose parts provides creative play in natural environments that help students develop a deeper understanding and appreciation of nature, which in turn, lead to the care and protection of the natural world.

Figure 2-2 *The "Loose Part Theory" allows for the use of a multitude of elements and objects that can be incorporated in a child's learning environment. These elements and objects become tools of learning that help to enhance play and allow for the use of creativity, which stimulates their minds and creates learning that is meaningful and lasting.*
(Photo Credit- progressiveearlychildhoodeducation.blogspot.com)

Participatory Design

Education is not a one-dimensional field and with so much scholarly research available, it raises the question why are schools continuously designed and oriented around a "one size fits all" form of educational environment? A designer takes into account the needs of the user before designing a space they will occupy. The public school system should take into account the students needs before designing the school environments they will be learning in. It is paramount to factor in what is important to the students when designing their learning environments. Wrapped up in the fundamentals of a particular child's learning style are their beliefs and core values. What a child views as important is often very different from what an adult views as necessary. It is paramount to factor in what is important to the students when designing their learning environments. This method of directing education from purely an adult's point of view is a mistake that is not only made by administration and teaching, but also by the designers building the child's learning space. Not taking into account the child's views can have a more profound effect than a lack of learning. Faith in children's desires and ability to learn and to socialize is important, and may serve as a self-fulfilling prophecy. When this faith is supported by physical expressions in design, it arouses the child to justify it; expressions of lack of faith help to dampen the interest of the child and to bring about negative social relationships (Sebba 1986, 71). The intentions are good and well received by adults, but when you ask a child how they would like to learn the sentiment is often not a shared one. Participation in the design dialogue gives children the opportunity to express what is important to them. These same principles ring true when

designing a community space and asking for public input of what they would like to see. Why would you not do the same for children? By properly evaluating a child's outlook on learning and their environment and how they both relate, you can create a learning environment that is both positively stimulating and educational. You also create a learning environment that they are able to take ownership and responsibility of. This gives them life skills that will carry further than the institutional frames of their basic education, but will translate into essential social life skills.

There is a considerable amount of research suggesting that one of the main problems with US public school system is directly related to the classroom environment of the school. Unfortunately, this fact is rarely highlighted and often camouflaged by political agenda that is only focusing on standardize test scores of a school district. This causes a domino effect on education. Members of the school board pressures school administration, which then pressures teachers to place more pressure on the students to improve their test scores. They are given a set of standard topics and are under the constant mandate of having these items completed and checked off so that they may produce a child that has been standardized and evaluated as complete for that level of education. This creates intense pressure for teachers to always focus on results, which is then adversely placed on the students. We live in an achievement-oriented society with an intense focus on what should be accomplished for the sake of the future. This orientation- leads to the misguided introduction of formal academic instruction at an early age and high-stakes testing soon after children enter school. This places a great deal of stress and consequently affects the overall well being of the child (Wilson 2008, 9). This

route of thinking is at the root of the problems with the educational environment. The teacher has a large influence on how a child learns regardless of whether the child is asked to learn indoors or outdoors. Understanding this, a teacher can be more than just an agenda and a regulator of testing material. The teacher has an important role of constantly shaping the physical space, both indoors and outside, and this space helps to shape the child's learning. Teachers' thought and decision making in regard to their environment is critical to the entire process of teaching and learning (Stine 1997). A teacher, undoubtedly, plays one of the most critical roles in a child's education. Teachers need to be included in the design process. A tenured teacher has become a master of important issues such as safety. Their professional advice and experience will be an invaluable source for the designer. They will have direct testament of the problem of overstimulation and inattentiveness within their own classroom. A teacher has the ability to create connections through all aspects and outlets of the classroom. Each subject has the ability to connect to the next subject creating a framework of learning. By creating these connections, as the facilitator, you guide the learners to construct meaning that is lasting and has direct applications to life inside and outside the confines of school.

Designers and teachers are able to create learning environments that are both positively stimulating and educational when you properly evaluate a child's outlook on learning, their environments and how these relate. Consequently, addressing the student's viewpoints help to create a learning environment that the students are able to take ownership, responsibility, and pride in their work and subsequently, create a stewardship towards their school and community.

Synthesis of Literature Review

The literature review provides support for the goals and the research. Through the evaluation of the outdoor learning environment and nature's effect on learning, the literature provides support to the questions of defining the learning relationship between the indoor and outdoor experience. Evaluating experiential and hands-on learning provides support of the question about the benefits of using different models of learning. When used in conjunction with participatory design, experiential and problem based learning help create connections with the surrounding environment and the research suggests that children are more creative and have enhanced learning in green spaces rather than in built spaces. It further states that nature is essential to the physical, psychological and social well being of a child's development and supports the notion that when a learning environment is created to provide students with access to nature, it helps create environmentally responsible behavior.

CHAPTER THREE

METHODOLOGY

Chapter Organization

This chapter explains the research methodology used in this study. The first section discusses the research orientation. The second section defines the data collection methods. The third section discusses the research process for creating the design framework and provides a roadmap of the research methodology. The fourth section further maps out and explains the details of the research methods used and also explains the limitations and benefits of this study, the process, the implementation, and finally, an analysis of the study as a whole.

Research Orientation

This study explores specific characteristics that are found within a student's academic environment that stimulate and enhance the ability to learn. The literature review has shown what is required to have a quality outdoor learning environment for children, but it is necessary to provide additional support through qualitative research. The choice of qualitative research for this study was ideal due to the lack of initial data available on the use of outdoor learning and its efficacy as a tool in schools in the United States of America. By using qualitative research methods, this study examines the underlying motivations, opinions, and reasons of whether an outdoor learning landscape would be successfully utilized in schools. This study's results will help develop additional future studies that could use quantitative research methods, such as testing a sample population of students using the learning environment over an extended amount of time to create

statistical data that may potentially support or refute its use. The combination of the research from the literature review and the qualitative research methodology used in this study will further strengthen the reliability of this study and assist in the formation of a new design framework.

Data Collection Methods

This study implements the use of two qualitative research methods in the form of precedent studies and survey questionnaires. The precedent study provides a comparative analysis of three exemplary schools related to the study objectives. The use of surveys given to students and teachers at the same local middle school help inform the design of the outdoor learning landscape to be implemented. The procedures for each research method will be further explained in detail below. The results and conclusions for each method are in chapter five.

Method One: Precedent Studies

A comparative analysis was used for three schools found in the United States that embodied exemplary outdoor learning environment design, concept and philosophies of learning relative to middle school children. The rationale for selecting these three schools for evaluation included awards and achievements from peers in both the design intent and the overall effectiveness of meeting each school's objective in regards to learning. Precedent studies were evaluated on the same themes that were prevalent throughout all three schools. Through review and observation, the central themes and characteristics were examined for each school to determine their underlying importance in the success of each schools learning environment.

Method Two: Questionnaire Survey

A questionnaire was used to bring out different perspectives, opinions and concerns regarding the use of an outdoor learning environment at the target school- Dacusville Middle School. The participants of this survey consisted of students in all class levels and all of the teachers at Dacusville Middle School located in Dacusville, SC. Two separate surveys were designed: one for the students and one for the teachers. The student questionnaire asked eight questions that consisted of multiple choice and short answers. These questions were designed to address the specific interests that each student had in regards to the outdoor activities at their school and the outdoor activities away from school. Students were also asked subject specific questions about the hardest and easiest concepts for them to learn and to identify amenities and games that they would like to have included in an outdoor learning garden. Lastly, they were asked to give their gender and year in school. The teacher survey asked six short answer questions including identification of difficult concepts for the students to learn and any specific subjects and concerns that could potentially be taught through the use of an outdoor landscape. The survey asked if they took their students outside the classroom to learn concepts and to explain why they did or did not do so. The last question asked teachers to list their main concerns about outdoor learning. The primary purpose of this survey was to provide insight into the specific individual wants and concerns of the school and to serve as a tool for encouraging participatory design at Dacusville Middle School. The survey answers help assist in the successful design and implementation of an outdoor learning environment at Dacusville Middle School.

Through the use of precedent studies and the results of student and teacher surveys, this study identifies and defines specific guidelines that support a learning environment that stimulates learning and achievement.

Creative Inquiry and Design Development

Another important factor in the success of this study is the use of a participatory design approach that included the input of a group of highly motivated undergraduate students enrolled in a Clemson University Landscape Architecture based Creative Inquiry course. Through the guidance of their professor, these students helped with the design process and even more importantly, assisted with the implementation of the outdoor learning garden itself. This research study could not have been successfully completed without the use of a participatory design approach that included all levels of input from administration, teachers, the students at Dacusville Middle School, and the students in the Clemson University's Landscape Architecture Creative Inquiry course.

The research methods and the participation of the undergraduate students enrolled in the Creative Inquiry course all helped to provide a network of resources that helped to answer the research questions and develop study findings that strongly support a new set of design guidelines that can frame the design and the implementation of outdoor learning environment in a site-specific academic settings. Furthermore, the students of the Creative Inquiry course played crucial roles in the installation of the learning landscape at Dacusville Middle School.

Analysis and Design

Qualitative methods were used to inform the initial direction of the design process. Through the evaluation of three different precedent case studies and student/teacher surveys, research informed ideas began to accumulate, helping with the initial formation of the design framework. This framework will serve as guidelines and frame the application of the learning landscape at Dacusville Middle School.

Figure 3-1 *Professor and undergraduate students meeting for the Creative Inquiry course at Clemson University.*

CHAPTER FOUR

METHODOLOGY RESULTS AND CONCLUSIONS

Precedent Study Observations

Examining exemplary schools helps to identify the elements that are working and eliminate or alter the ones that are not working. Nueva School in Hillsboro CA; Manassas Park Elementary in Manassas Park, VA; and Adams Elementary School in Utah were the three precedent schools identified for a comparative analysis of their design and use of outdoor learning environments.

Precedent Study School One: Nueva School

Figure 4-1 *Sustainable concepts, such as water management, are found throughout the design of the Nueva School campus. These concepts are designed as focal points of learning for the students.* (Photo Credit- http://www.asla.org/2010awards/images/largescale/050_09.jpg)

(Nueva School Continued)

Location: Hillsborough, CA USA

Designers: Andrea Cochran Landscape Architecture

Awards and Accolades: 2010 ASLA Professional General Design Honor Award

Basic School Information: Nueva School is a Pre-K to 8th grade experimental private school that emphasizes social-emotional learning, creative arts, and integrated studies. It aims to inspire passion for lifelong learning, foster social and emotional acuity, and help to develop a child's imagination ("ASLA 2010 Professional Awards, Nueva School" 2010).

Common Themes and Characteristics of the NUEVA SCHOOL Learning Environment

Types of Learning Environments

- Very few textbooks are used and the students learn kinesthetically through inquiry, group discussion and organic discovery

Sustainable Principles Included in Design

- The Nueva School has become a model of sustainable design in many areas including its ecological management of stormwater. Green roofs, etc.

Nature Based Learning Principles

- Incorporated the use of local flora and fauna in all aspects of the design and incorporated these elements throughout the entire curriculum of every subject.

Learning Styles that the Design Supports

- Experiential and Problem Based Learning

Other Learning Principles Stressed

- Interdisciplinary leaning is promoted through the connections of one subject to the next

Participation in Design Process

- The school held a competition for the new school building that included insights from teachers and students. The students interviewed by the design team and tested various furniture options and voted on the final selections.

Participation in Building/Construction Process

- Students and teachers were involved in the entire design process from inception to completion

(Nueva School Continued)

Connections with Immediate Surroundings

- The project is situated along a slope and is visually connected to the larger landscape and adjacent mature woodlands extend the school's learning environment and provide an anchor from an existing heritage oak that is situated in the schools' center courtyard.

Common Thread that Connects Users

- There is an underlying theme of sustainability throughout the entire design and use of the school's campus.

Connections with Community

- The design team worked with local artists to imprint concrete bands in the paving of leaves species of native plants. The school is designed on the guidelines that it would "connect with nature, be a teaching tool, foster community and collaboration, and be accessible to all."

Shared Functions/ Uses (Community and School)

- The school was designed to be accessible to both the student and the surrounding community.

Indoor/Outdoor Relationship

- The Hillside Learning Complex was designed to incorporate the outside with in indoors and vice versa. Classrooms are situated to provide extended views of the surrounding outdoor environment and the green roof on top of library is set lower to provide access as a learning tool.

Figure 4-2 *Outdoors gathering areas are situated throughout the campus to bring the outdoors indoors and utilize views of the natural topography and provide references for teaching sustainable concepts such as the green roof on the library.* (Photo Credit: Tim Griffith)

(Nueva School Continued)

Curriculum Incorporated with Design

- Design elements dovetail with the school's curriculum and create outdoor spaces for the students to engage in all the process of the local ecosystem.

Special User Considerations and Amenities

- The Hillside Learning Complex is a newly designed extension of the original Nueva School
- Campus and serves as an experimental private school that emphasizes social-emotional learning, creative arts and integrated studies. The school's aim is to inspire passion for lifelong learning, foster social and emotional acuity, and develop children's imaginations.

Elements/Feature Learning Play

- The entire site has been designed and crafted to serve as learning and play space for the students.

("ASLA 2010 Professional Awards, Nueva School" 2010)

Precedent Study School Two: Manassas Park Elementary School

Figure 4-3 *Manassas Park's design team created themes for each floor inside of the buildings that directly relate to the surrounding forest ecosystems outside. This design strategy helps students make connections through hands-on learning.* (Photo Credit- VMDO Architects)

(Manassas Park Continued)

Location: Manassas Park, VA USA

Designers: Siteworks

Awards and Accolades: 2011 ASLA Professional General Design Honor Award,

LEED Gold certified project

Basic School Information: Manassas Park is an independent city surrounded by the affluent northern Virginia suburbs of Washington, DC. In 1975, the city began piecing together a series of first generation school facilities. In 2000, the city began rebuilding all of its public schools, which was an enormous challenge for a city with a low tax base. The school campus is tightly surrounded by tract housing, private forest, and historic landmark Camp Carondelet (forested winter quarters of the Confederacy's Louisiana Brigade between the first and second Manassas campaigns) ("VMDO Architects-Manassas Park Elementary School + Pre-K" 2012).

Common Themes and Characteristics of the MANASSAS PARK Learning Environment

Types of Learning Environments

- School building was built on an existing parking lot and pushed tightly against the camp forest to preserve existing open space and create a suburban "school in the woods."
- The Initial structure is combined with additional porous paving and native woodland plantings to structure outdoor learning habitats that will over time become contiguous with the adjacent forest.

Sustainable Principles Included in Design

- Both the school building and site are designed to be an expansion and expression of the forest ecosystem while integrating holistic systems for optimal management of water resources.
- The infrastructure of the courtyard came from white oak wood plank and log benches that were salvaged from a nearby construction site.
- The stormwater garden and bus stop are also planted with native Hydric species and are framed by amphitheater seating, a wood stage, and a bench made from recycled steel and regionally harvested black locust. They will eventually provide additional passive interior

(Manassas Park Continued)

cooling through shading of building facades that will increase energy efficiency as the trees mature.

- These spaces where designed to have small carbon footprints and require little to no gas-powered maintenance.

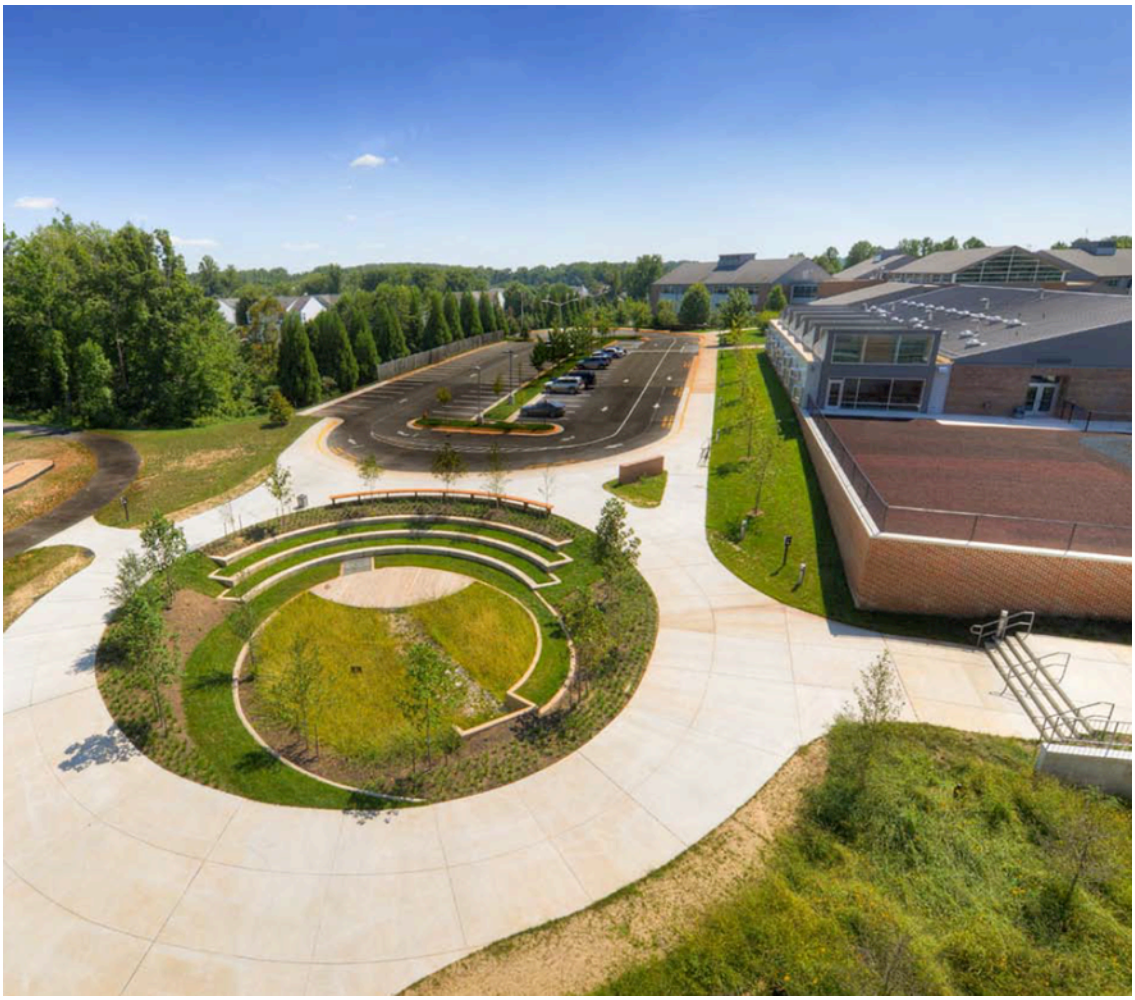


Figure 4-4 *The incorporation of native plants species can be found throughout all of the outdoor spaces at Manassas Park Elementary School. This approach aids in student learning of the surrounding ecosystem as well as to serve as low-impact educational spaces.* (Photo Credit- Sam Kittner)

Nature Based Learning Principles

- Design inspiration comes from studies that have shown the benefits to student performance and health when schools are designed with fresh air, natural daylight and connections to the outdoors.

(Manassas Park Continued)

- Designed with a "nature is a place to play" theme
- Hydric landscapes are featured in a manner giving children a new appreciation for water's vital role in their lives.
- A broad planting palette of native species, which shape low-impact educational spaces, enhances ecology diversity.
- Organized into 3 "houses" – each house extensively themed around a season and each floor representing a corresponding level of the forest. Each classroom is named after a species commonly found in that season and place. In this way children associate their homerooms with plants and animals rather than numbers.
- Outdoor labs for studying and cultivating native plants, studying climate and weather, telling stories and for exploring native flora and fauna.
- Designed around the premise that people, especially children cannot be expected to preserve or protect something they do not understand.

Learning Styles that the Design Supports

- Environmental and Nature Based Learning

Other Learning Principles Stressed

- Design decisions were made with the expressed goal to showcase as many teachable moments as possible. The children are encourages to use the numerous exterior breakout spaces and to explore the piedmont landscape directly.

Participation in Design Process

- No specific were noted, but design team has created a yearly commitment to lecture on environmental issues in conjunction with a service day undertaken with the students, faculty, and administration of the school.

Participation in Building/Construction Process

- No specific were noted, but design team has created a yearly commitment to lecture on environmental issues in conjunction with a service day undertaken with the students, faculty, and administration of the school.

Connections with Immediate Surroundings

- Embedded within a residential neighborhood, enabling the school to implement a system of "walking stops" and "bike trains" for neighborhood children.
- Broader disturbed areas were re-vegetated with native warm season grasses and wildflowers, echoing the savanna landscapes created by the eastern woodland Native Americans.
- The school campus is tightly surrounded by tract housing, private forest, and historic landmark Camp Carondelet (forested winter quarters of the Confederacy's Louisiana Brigade between the first and second Manassas campaigns).

Common Thread that Connects Users

- Design also adds the responsibility of cultivating environmental stewards in their community of teachers, learners, and parents.

(Manassas Park Continued)

- A comprehensive signage program reinforces each teachable moment by highlighting green building facts, demystifying sustainable building systems, and describing flora and fauna found in the adjacent forest.

Connections with Community

- All designed gathering spaces were designed to be flexible uses that accommodates public meetings and other community functions
- Gymnasium was built with a full-size basketball court (which is atypical for an elementary school) to serve the community. To further support the community, the gym also houses an office and storage for the Parks and Recreation Department.

Shared Functions/ Uses (Community and School)

- Camp Carondelet- used frequently for education, exercise, recreation, and tourism. School parking lot serves as a visitor's parking lot for the camp.

Relationship with Its Surroundings

- Connects the school to the regional parks system.

Indoor/Outdoor Relationship

- Interior extended learning spaces offer dramatic and surprisingly intimate views of the neighboring mixed oak forest, while elementary classrooms face shady moss- and fern-covered learning courtyards featuring "fallen" tress and other particularities of an eastern deciduous forest floor. The design structure of the campus optimizes the relationship between indoors and outdoors, school and community, ecology and culture, and challenges each member to be knowledgeable, responsible and creative in the ways that they inhabit the site and the planet.

Figure 4-5 *The indoor classrooms at Manassas Park were designed to have a strong connection with the outdoor environment, with an extra emphasis on the historic forest ecosystem surrounding the school.* (Photo Credit- Sam Kittner)

(Manassas Park Continued)

Curriculum Incorporated with Design

- Design decisions were made with the expressed goal to showcase as many teachable moments as possible.

Special User Considerations and Amenities

- Design team created a yearly commitment to lecture on environmental issues in conjunction with a service day undertaken with the students, faculty, and administration of the school. Designers tailored the level of detail to the scale of the children.

Elements/Feature Learning Play

- The entire campus is designed to be an exploration play that assists in learning with its interwoven concepts of cultivating environmental stewardship.

("ASLA 2011 Professional Awards, Manassass Park Elementary School" 2011)

Precedent Study School Three: Adams Elementary School

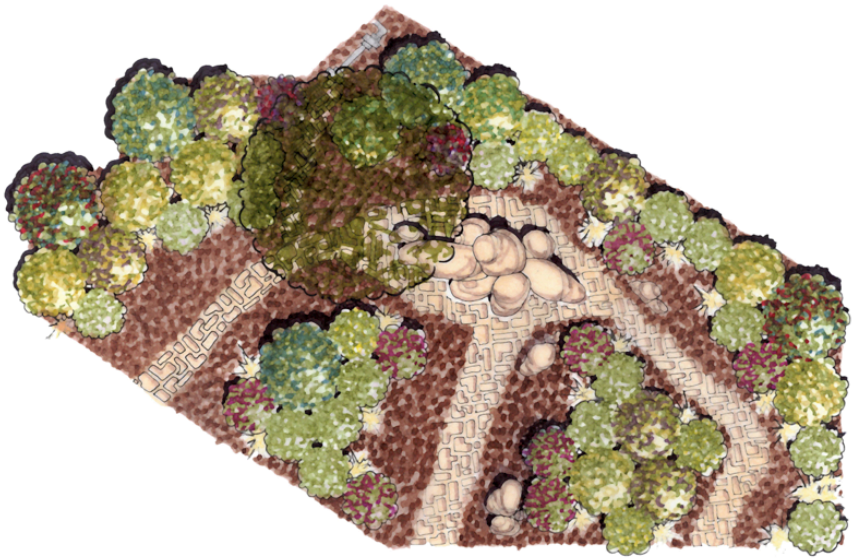


Figure 4-6 *The design of a school entryway garden was achieved through a participatory design process that included enrolled fourth grade students.* (Photo Credit- Amanda J. Dunlap)

(Adams Elementary Continued)

Location: Utah

Designer: Amanda J. Dunlap. Student ASLA, Graduate, Utah State University

Awards and Accolades: 2011 ASLA Student Award of Excellence: Community Service.

Basic School Information: Adams Elementary Schools is a public school that served grades kindergarten through sixth grade. It has is located in Logan, Utah and has approximately 600 students. It served as a site for landscape architecture graduate student, Amanda J. Dunlap at the University of Utah. Her project incorporated 20 curriculum plans designed for fourth graders to help design an entryway garden that used native plants and conserved water ("ASLA 2011 Student Awards, Adams Elementary School Garden Based on Experiential Learning" 2011).

Common Themes and Characteristics of the ADAMS ELEMENTARY Learning Environment

Types of Learning Environments

- Project involved the development and implementation of lesson plans based on design process to teach core academic standards to fourth grade students while introducing them to landscape architecture and keeping arts in the school.

Sustainable Principles Included in Design

- Students propagated their own plants to add to the garden.

Nature Based Learning Principles

- Students were asked to incorporate native plants and design for the support specific native wildlife such as indigenous butterflies and frogs.

Learning Styles that the Design Supports

- Hands-on, Experiential Learning: Through the steps of the design process, an experiential learning model based on the studio's atmosphere was used to create a project familiar and meaningful to the students.

(Adams Elementary Continued)

Figure 4-7 *Twenty curriculum plans were designed to involve the students in every step of the design process. They presented their designs to their school and their parents and teachers acted as the jury for the final design.* (Photo Credit- Amanda J. Dunlap)

Other Learning Principles Stressed

- Opportunity arouse to combine core elementary school curriculum with the arts through landscape architecture
- Design created learning of a vocabulary of landscape architecture terms and opportunities to develop presentation skills.
- To aid the design process, each lesson plan would include goals and objectives for the activity; a list of the core curriculum standards that would be met according to the lesson plan; specific vocabulary for the students to learn; a list of preparation materials and activities; a detailed description of the sequence of instruction including questions; activities, definitions to vocabulary, and minutes to complete each aspect; contingency plans for weather or early-finishers; standards for evaluation; and reflections on the end product of the day.

Participation in Design Process

- Students worked through the design from inception to implementation of the design process to create a school entryway.

(Adams Elementary Continued)

- Elementary school principal stated a desire to have a native, water-wise garden to beautify the entry of the school**.**
- Project incorporated a graduate student from the local landscape architecture program paired with a national program for artists and a landscape architecture professor to provide an experiential learning opportunity for some of his students.
- The students presented their plans for the garden to their parents and sitting as the jury.

Participation in Building/Construction Process

- Students propagated their own plants to add to the garden.
- Parents volunteered time and machinery to prepare the site for planting, stripping the site of the existing dead shrubs and turf.
- Local businesses donated several plants for the installation, and a few community members dug up plants that were thriving in their own garden to transplant at the school.

Figure 4-8 *The design and construction of the school garden at Adams Elementary School was achieved through a participatory design process that included enrolled fourth grade students, teachers, and the community.* (Photo Credit- Amanda J. Dunlap)

Connections with Immediate Surroundings

- The garden was to serve as a gateway entrance garden for the school.

(Adams Elementary Continued)

Common Thread that Connects Users

- The students were responsible for the design from inception to implementation of the design process to create a school entryway. Sign was added recording all the names of the fourth grade students with photos of the design process and the final site plan.

Connections with Community

- The community donated plants, equipment and time to install the students design

Shared Functions/ Uses (Community and School)

- The project was meant to foster environmental literacy and promote visual arts while creating a space that the teachers can use as a venue to teach their subjects.

Relationship with Its Surroundings

- The students were asked to incorporate native plant species and create a "water wise" learning environment that would beautify the landscape of the school.

Indoor/Outdoor Relationship

- The students were asked to try to make school subjects relate to the ideas that they were designing for the garden to make learning connections.

Curriculum Incorporated with Design

- During the design process 20 lesson plans were created that integrated landscape architecture, mathematics, creative writing, science, and art into fourth grade curriculum.
- The design process used landscape architecture to incorporate many of the core education standards set out by state boards.
- The design process of landscape architecture project created a venue for teaching mathematics, science, history, and creative writing skills.

Special User Considerations and Amenities

- Due to limited funding, the design was installed in a phased process. Design had to be water-wise and use native plants

Elements/Feature Learning Play

- The design of the curriculum process incorporated games and activities that were fun to help foster creativity and generate ideas. The students were given a new game/task every curriculum to keep ideas fresh and stimulating for the students.

Synthesis of Precedent Studies and Initial Design Guidelines

After the extensive research on the characteristics and elements of a successful learning environment, I chose the route of qualitative methodology in reviewing and analyzing the three precedent studies that highlight the goals and answer the questions of

this study. The connections that each precedent study supports in my literature review are the following:

1. *Hands-On Learning* (Experiential and Problem Based Learning) - These specific learning styles and techniques foster learning in an outdoor classroom.
2. *A Strong Connection to the Outdoor Learning Environment* **-** This includes the effects of nature on learning and the positive role that play has in the learning process.
3. *A Participatory and Collaborative Learning/Design Approach* **–** The design approach should be a participatory process that is a learning experience for all parties involved: students, teachers, and administration alike.

A preliminary set of guidelines were formed from the findings of the literature review and the precedent case studies to help support the initial development of the outdoor learning landscape that would be implemented at Dacusville Middle School. These initial guidelines were used to help guide the design process during the Creative Inquiry course and help setup a framework for the final garden design. These guidelines were further defined and modified after the student teacher survey results, feedback from the middle school, and the feedback and observations from the Creative Inquiry course sessions.

Initial Design Guidelines

1. The outdoor classroom should be set up in a way that allows for many choices that encourages creative learning.
2. The outdoor learning environment should provide opportunities to share with the class their ideas and views on what is being asked of them to learn. In return, the class learns different viewpoints and the child is instilled with pride in their learning accomplishments.
3. The outdoor classroom should foster learning that creates connections with other subjects and ideas that can generate deeper thinking and meaning to the child.
4. The outdoor learning space should be flexible, allowing for a multitude of activities and interests for the child.
5. Allow students to determine the success or failure of an activity. Having their input will engage their desire to learn.
6. Organize the outdoor learning environment to provide learning that may accommodate large and small group learning as well as individual learning.
7. Learning curriculum should be organized in a manner that allows for various approaches of learning and the curriculum should try to create relevancy to the child's own life experiences to create a more profound learning.
8. Teachers should guide learning in a way that allows for a separation of quiet and noisy activities. This allows children with different learning styles to be able to concentrate and still be able to focus when in large groups outdoors.

9. Allow for different learning approaches while in the outdoor learning environment such as problem solving activities, reading out loud to the class, and other activities that emphasize hands-on experiential learning.
10. Teachers and students should be involved in the design and building process to allow for them to create a connection with the space and to develop a sense of stewardship for their outdoor learning space.

Survey Observations and Results

The questionnaire surveys were given to every student and teacher present at Dacusville Elementary School on March 6, 2012. The number of teacher surveys filled out and returned was 16. The number of students that filled out and returned surveys was 283. The total number of surveys broken down by gender and year in school was as follows:

FEMALE 6th Graders: 42 Surveys	MALE 6th Graders: 44 Surveys
FEMALE 7th Graders: 52 Surveys	MALE 7th Graders: 49 Surveys
FEMALE 8th Graders: 48 Surveys	MALE 8th Graders: 48 Surveys

Student Survey Responses

Results of the student surveys varied from class grade and gender, but common trends were noticed in the highest-ranking choices and responses. Common trends for the student surveys as a whole were:

- Want more areas to play sports
- Complex math with multiple steps was considered the most difficult (fractions, multiple-step equations, and division)

- The addition of water, vegetables, and movable objects were preferred in an outdoor learning environment
- Small group games were preferred over larger group games

The following are the top three noted trends for each grade both male and female for each survey question:

Question 1: What activities do you like to do when you are outside?

1. Football
2. Basketball
3. Baseball

Question 2: What new features or activities would you like to have at Dacusville Middle School campus?

1. Football Field
2. Volleyball Net/Team
3. Baseball/Softball Field

Question 3: What part of math is easiest for you?

1. Addition
2. Multiplication
3. Fractions

Question 4: What part of math is hardest for you?

1. Fractions
2. Multiple Step Equations
3. Division

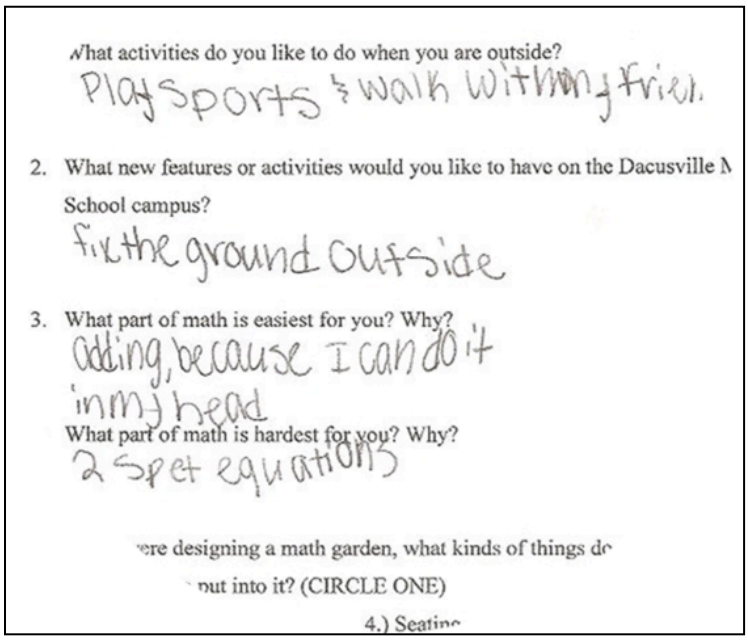
Question 5: If you were designing a math garden, what kinds of things do you think you would want to put into it?

1. Water
2. Vegetable/Edible Plants
3. Movable Objects

Question 6: What type of games do you like to play outside?

1. Dodge Ball
2. Four Square
3. Wall Ball

*For a more complete analysis of each question by grade and gender, please see Appendix B for student survey result graphs.



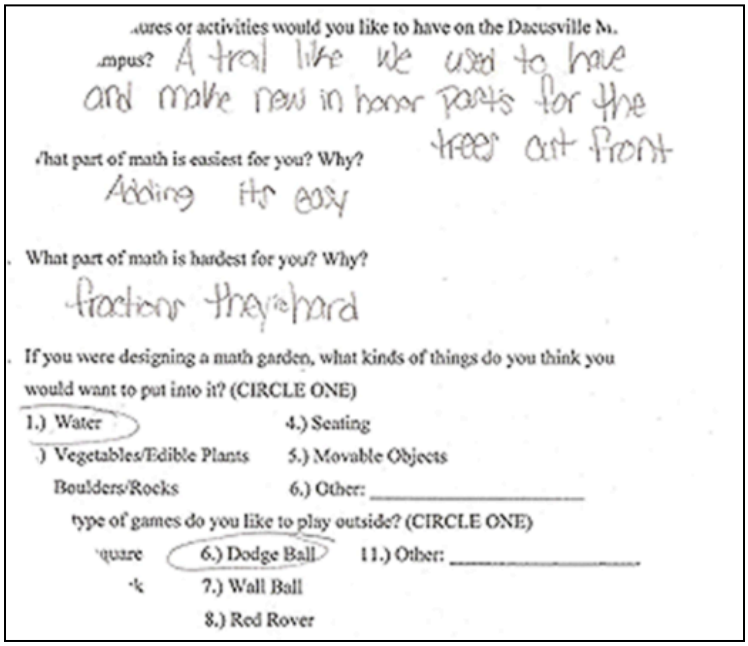
What activities do you like to do when you are outside?
Play sports & walk with my frien.

2. What new features or activities would you like to have on the Dacusville M
School campus?
fix the ground outside

3. What part of math is easiest for you? Why?
adding, because I can do it
in my head
What part of math is hardest for you? Why?
2 spet equations

ere designing a math garden, what kinds of things do
put into it? (CIRCLE ONE)
4.) Seating

Figure 4-9 *Example from student survey showing answers from various grade and genders*



ures or activities would you like to have on the Dacusville M.
mpus? A trail like we used to have
and make new in honor parts for the
trees out front

hat part of math is easiest for you? Why?
Adding its easy

What part of math is hardest for you? Why?
fractions they're hard

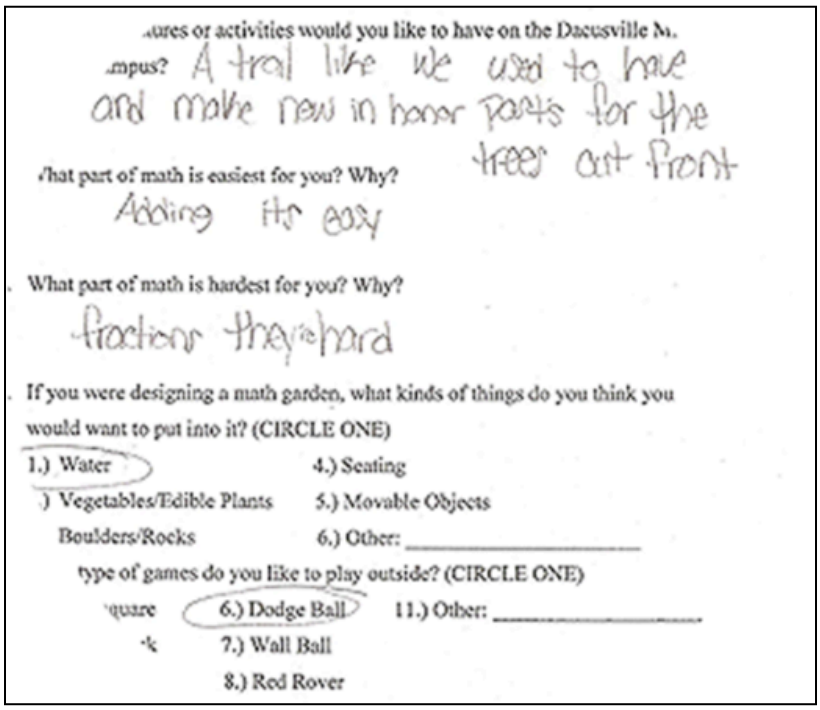
If you were designing a math garden, what kinds of things do you think you would want to put into it? (CIRCLE ONE)

1.) Water
) Vegetables/Edible Plants
Boulders/Rocks
4.) Seating
5.) Movable Objects
6.) Other: _____

type of games do you like to play outside? (CIRCLE ONE)

quare
k
6.) Dodge Ball
7.) Wall Ball
8.) Red Rover
11.) Other: _____

Figure 4-10 *Example from student survey showing answers from various grade and genders*



...ures or activities would you like to have on the Dacusville M...
...mpus? A trail like we used to have and make new in honor parts for the trees out front

...hat part of math is easiest for you? Why?
Adding its easy

What part of math is hardest for you? Why?
fractions they're hard

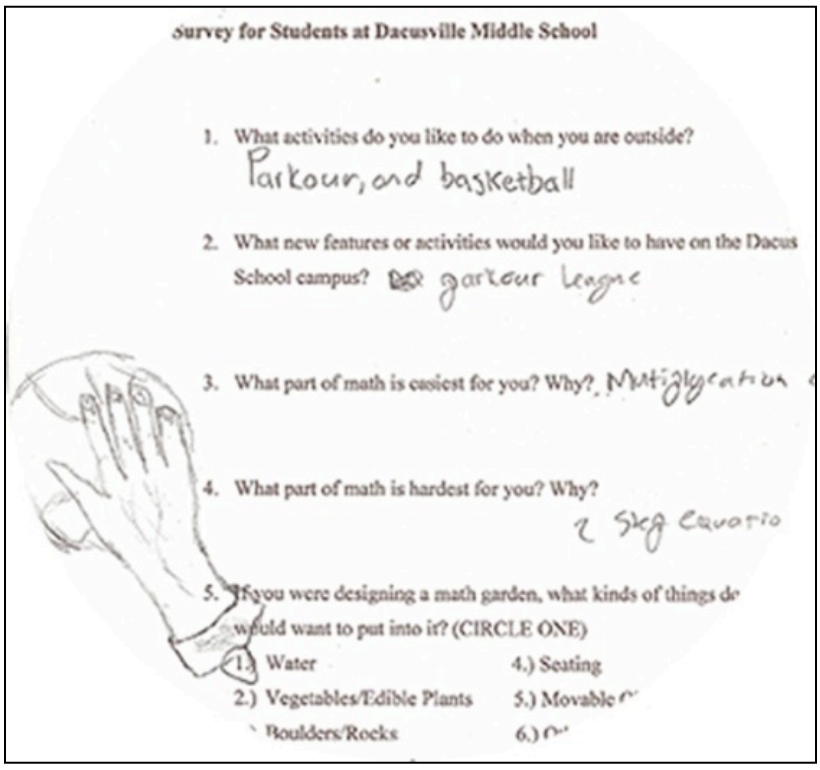
If you were designing a math garden, what kinds of things do you think you would want to put into it? (CIRCLE ONE)

1.) Water
...) Vegetables/Edible Plants
Boulders/Rocks
4.) Seating
5.) Movable Objects
6.) Other: _____

...type of games do you like to play outside? (CIRCLE ONE)

...quare
...k
6.) Dodge Ball
7.) Wall Ball
8.) Red Rover
11.) Other: _____

Figure 4-11 *Example from student survey showing answers from various grade and genders*



Survey for Students at Dacusville Middle School

1. What activities do you like to do when you are outside?
Parkour, and basketball

2. What new features or activities would you like to have on the Dacus School campus? parkour league

3. What part of math is easiest for you? Why? Multiplication

4. What part of math is hardest for you? Why?
2 Step Equatio

5. If you were designing a math garden, what kinds of things do would want to put into it? (CIRCLE ONE)
1.) Water
2.) Vegetables/Edible Plants
Boulders/Rocks
4.) Seating
5.) Movable
6.)

Figure 4-12 *Example from student survey showing answers from various grade and genders*

Teacher Survey Responses

Teacher responses were predominantly all unique to each specific question and their answers were similar as a whole. Predominant answers for the top four questions were:

- Abstract concepts and relationships are the hardest for students to learn
- Tools to learn measurements were suggested
- Seating was an important requirement for the outdoor learning space
- Most teachers currently do not take their classes outside, but would consider it if a suitable space was made available for them to use

Top three answers for each question were as follows:

Question 1: What is the most difficult concept for your students to understand?

1. Abstract Concepts and Relationships
2. Reading and Following Directions
3. Fraction Concepts

Question 2: What are a few subjects/concepts that you feel could be better explained and understood better through the outdoor landscape?

1. Measurement
2. Not Sure or No Answer Given
3. Teamwork

Questions 3: Do you plan your lessons solely on curriculum based standards?

1. All teachers said yes

Question 4: If it were proven effective, would you teach from a "learning garden" on a consistent basis?

1. All teachers said yes

Question 5: Do you take your classes outside to help learn concepts?

1. No (9 responses)
2. Yes (4 responses)
3. Occasionally (3 responses)

Question 5a: If you do go outside, where do you currently take students during class?

1. Stay Inside
2. Parking Lots
3. Behind the School or the Open Field

Question 5b: What would you like to see or use in an outdoor learning garden?

1. Measurements
2. Seating
3. Places to Sit and Read

Question 6: When you do take you class outside, what are you biggest concerns?

1. Staying Focused
2. Safety Issues
3. Disturbing Other Classes

*For a more complete analysis of each question please see Appendix B for teacher survey result graphs.

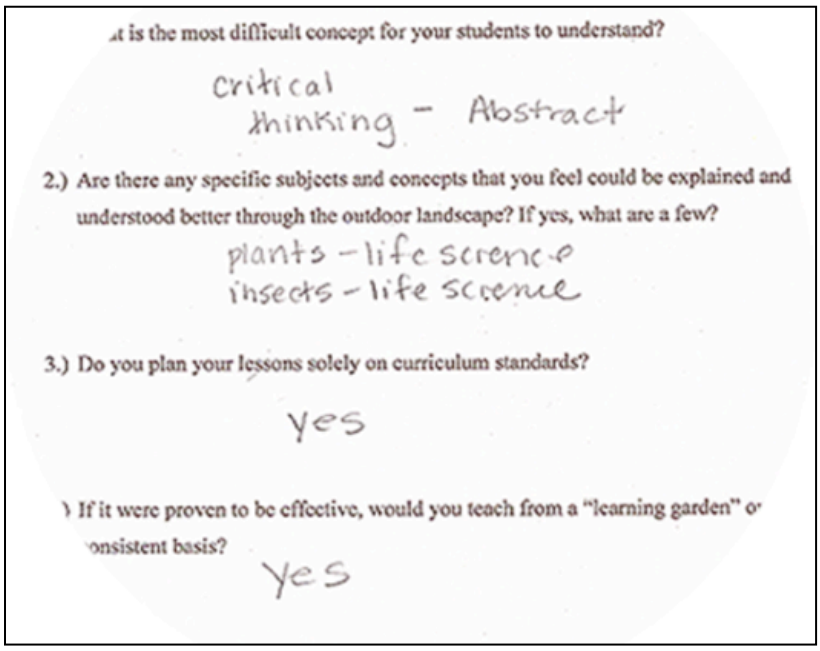


Figure 4-13. *Snapshots of Samples of Student and Teacher Surveys*

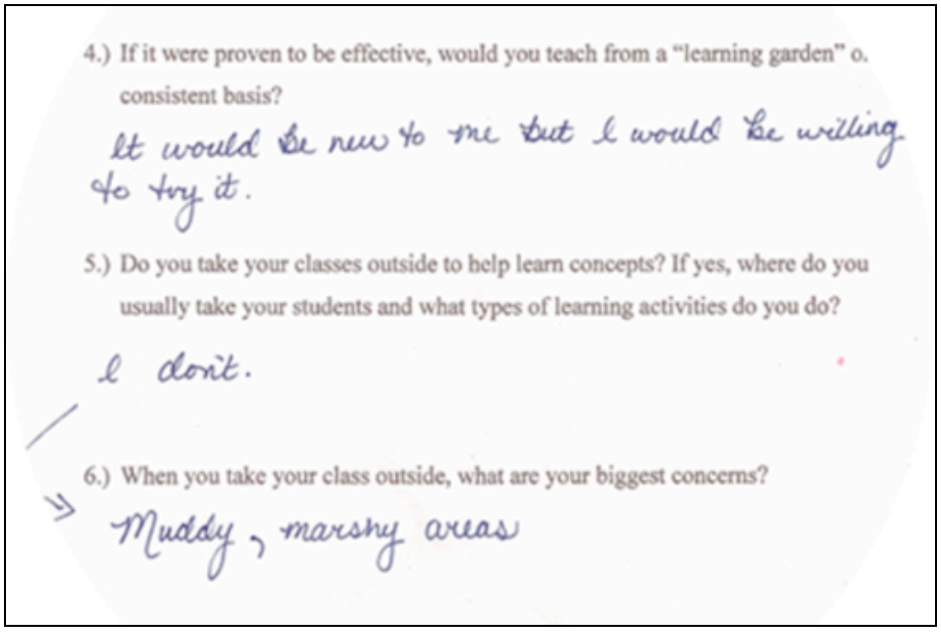


Figure 4-14. *Snapshots of Samples of Student and Teacher Surveys*

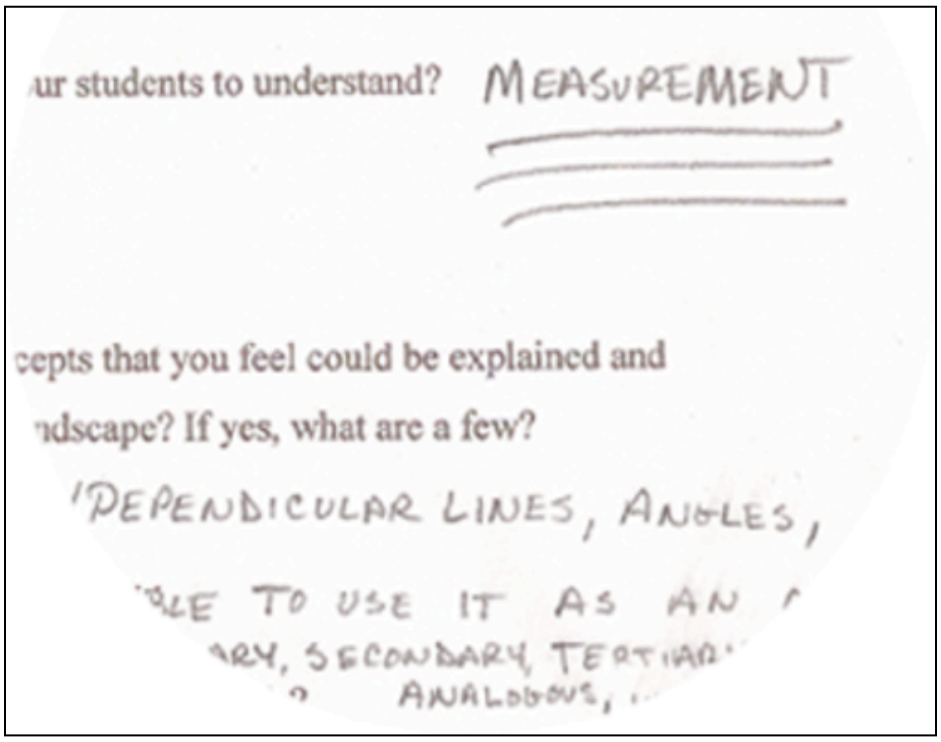


Figure 4-15 *Snapshots of Samples of Student and Teacher Surveys*

Conclusions and Learning Landscape Design Guidelines

The *Dacusville Middle School Learning Landscape Design Guidelines* were generated from the analysis of the initial design guidelines and the results of the student surveys and feedback from the teachers at Dacusville Middle School. These guidelines help focus the design of the math garden to be implemented on campus.

Dacusville Middle School Learning Landscape Design Guidelines

1. The designed space should be designed in a sustainable approach that allows for as little maintenance as possible. These spaces should be able to be maintained by the students and staff of the school with little to no time or cost.

2. Designers should make connections with each outdoor learning garden space to help create learning that has the ability to surpass the concepts of the individual curriculum and creates learning that is comprehensive.
3. Designers should incorporate the use of native plants and trees within the design to allow for a learning opportunity for the students of local flora and fauna as well as to provide a more healthy and sustainable learning landscapes with less maintenance.
4. Designers should incorporate teacher and student viewpoints and also allow for the surrounding community to have an opportunity to participate in the design process. This will allow for stewardship of the school by all participants and ensure its success
5. Steer away from designs that only allow for one activity or purpose. Designed spaces need to be flexible and have the ability to move and meet future needs of the students and teachers.
6. Allow the designed space to incorporate play. The designed outdoor learning environment should be a place that the students look forward to going to and are eager to learn in. This allows for more fundamental learning that can create a tool for teachers to reward good behavior.

CHAPTER FIVE

DESIGN APPLICATIONS AND IMPLEMENTATION

Site Introduction

Dacusville Middle School is apart of the United States public school system, located in Dacusville, SC. It is situated on approximately 113 acres and serves a rural community in the northeastern corner of Pickens County, South Carolina. The students range from grades 6th, 7th, and 8th and in 2011 it was listed as the smallest public middle school in Pickens County. The student to teacher ratio is 22:1 and it currently has a 0% dropout rate.

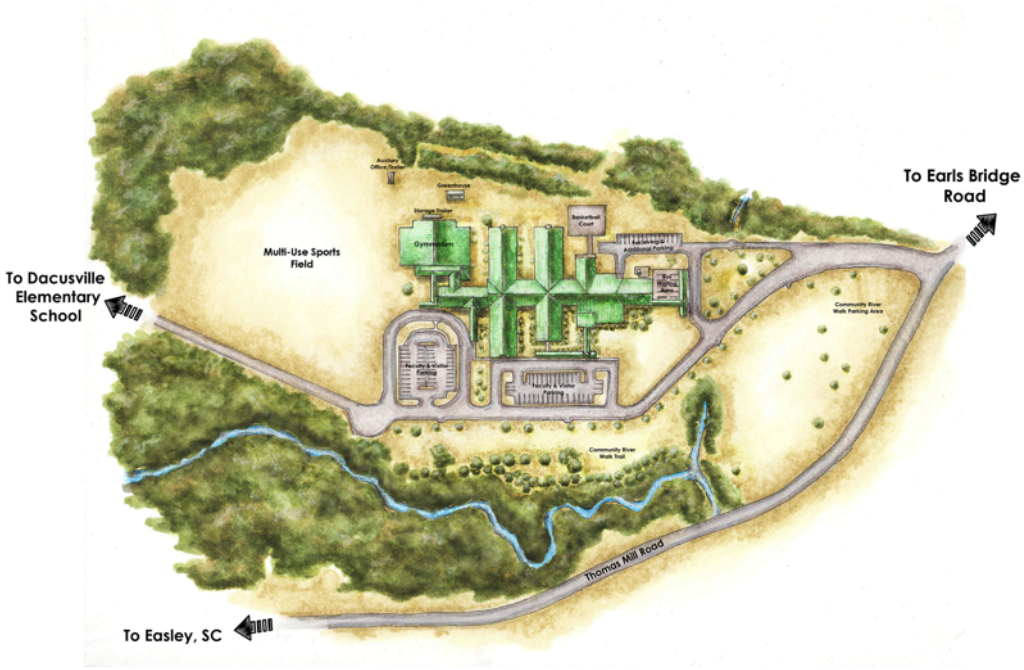


Figure 5-1 *Dacusville Middle School sits on 113 acres in Dacusville, SC within Pickens County in the state of South Carolina. It is currently the smallest public middle school in Pickens County.*

In 2011, Dacusville Middle School scored an absolute rating of "good" for the 2011 South Carolina Annual Report Card Score, which was an improvement from the previous

5 years. As a whole, Dacusville Middle School's students met the PASS (Palmetto Assessment of State Standards) performance standards set into place by the *No Child Left Behind Act.* Specifically, 43.5% of eighth grade students did not meet the expectations of the PASS in mathematics in 2011. When the subjects of science and mathematics are broken down by grade level, there was a significant percentage of eighth grade students not meeting the standards in mathematics in 2011 for progress towards the 2020 *South Carolina Performance Vision*. In light of this information, the decision to test the efficiency of an outdoor learning garden for the subject of mathematics at Dacusville Middle School was proposed and was met with enthusiasm from the school's administration, faculty, and students.

After several site visits to the school, a site inventory and site analysis was done to locate the best possible area to site the math garden.

Figure 5-2 *Site Inventory: Visual Analysis Map of Dacusville Middle School, Dacusville SC*

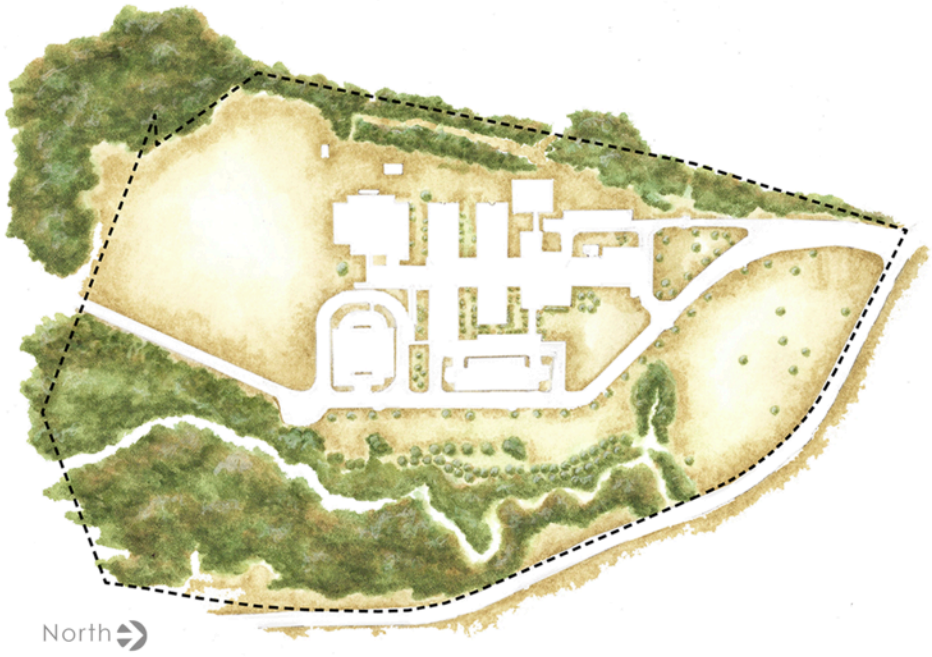


Figure 5-3 *Site Inventory: Existing Vegetation Map- The school has a moderate mixture of small to large evergreen shrubs that have become overgrown and in need of management.*

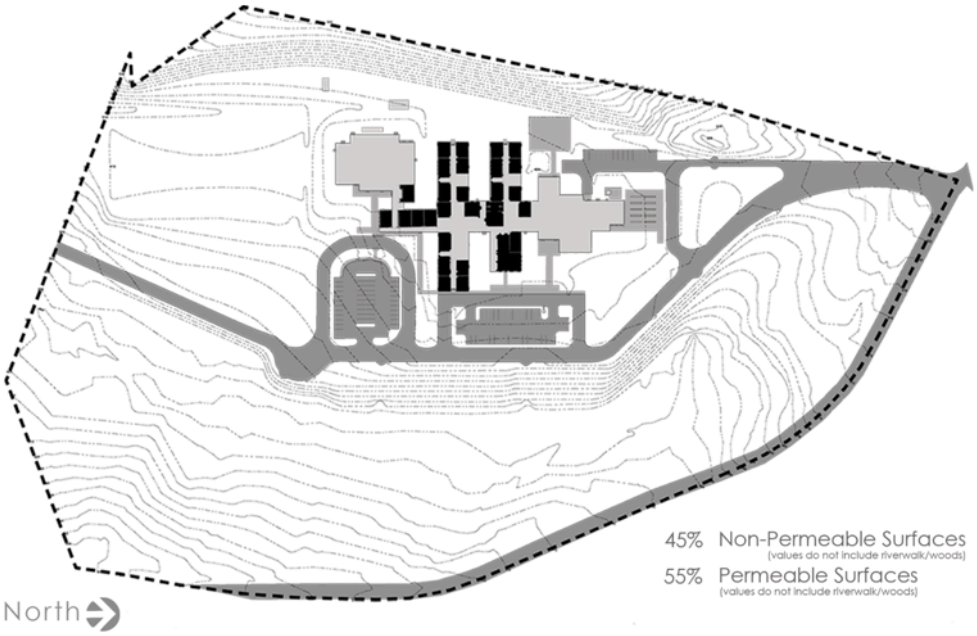


Figure 5-4 *Site Inventory: Existing Hardscape Map- All built structures are made from impermeable surfaces, causing a high amount of stormwater output during rain events and an increased heat-island effect during the hot summer months.*

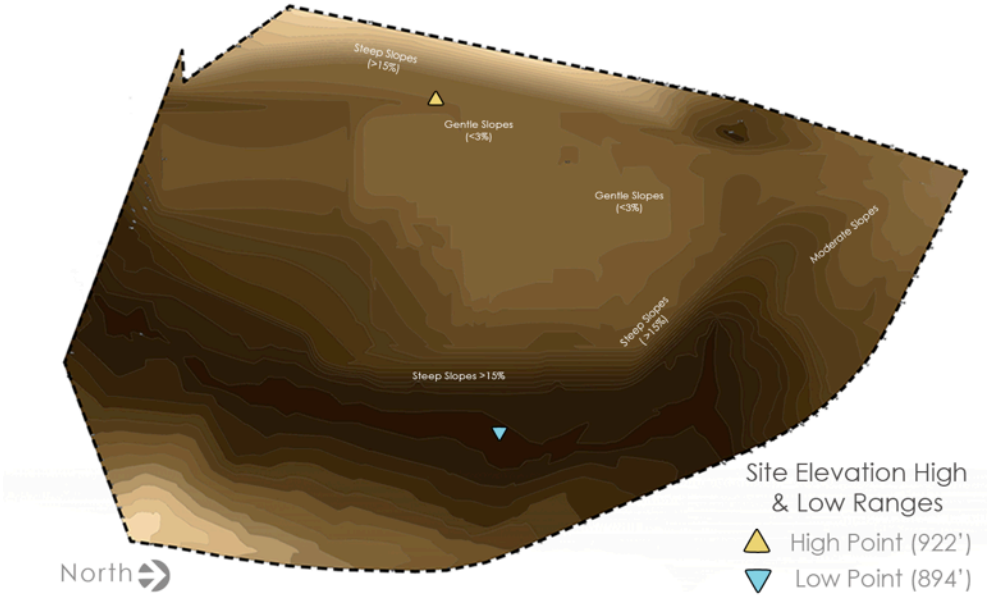


Figure 5-5 *Site Inventory: Soils & Topography Map- The schools topography is predominantly level near the school building and slopes begin to increase to over 15% as you head East towards the creek. The soils are consistent with the area and are suitable for growing a variety of plants, shrubs, and trees with the addition of organic amendments to aid in proper drainage.*

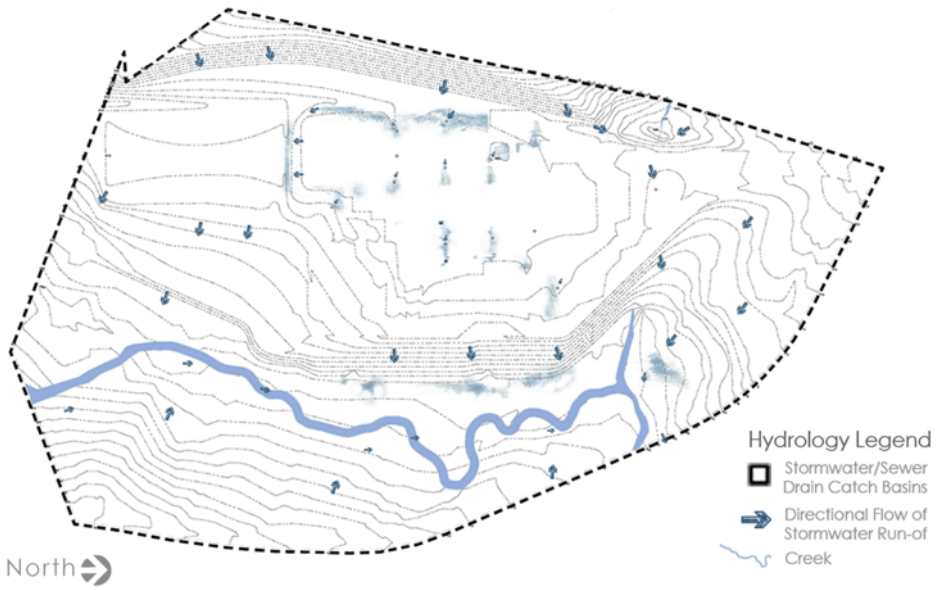


Figure 5-6 *Site Inventory: Hydrology Map- The small gently flowing creek transects the school's South to North boundary and has numerous beaver dams that frequently cause the creek's bank to flood the river walk trail area during and after moderate to heavy rain events. The creek is a contributing body of the water to the Saluda River, which is less than 2 miles away and is classified by the EPA as a priority watershed.*

Figure 5-7 *Site Drainage: Visual reference of problem areas- There are multiple areas throughout the school's campus that are in need of further modification to assist in a more effective drainage for the during rain events.*

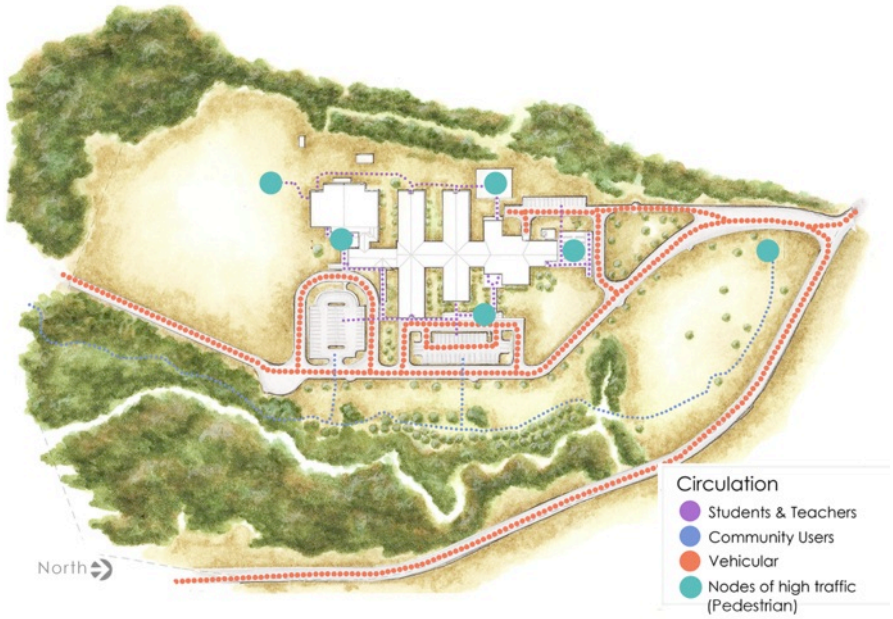


Figure 5-8 *Site Circulation Map*

Site Selection

After an extensive look at all of the site's contributing factors, possible garden sites were selected and evaluated for suitability for the proposed math garden. The possible locations for the garden were narrowed down to three possible locations, designated as Site A, Site B, and Site C.

Figure 5-9 *Site A- Facing Southeast towards the back of school and left of the existing greenhouse.*

Site A was level with good drainage; free of utility lines; and the soil was tested to be suitable for a wide variety of plants, shrubs, and trees.

Figure 5-10 *Site B- Facing East looking at the back of the gym to the right of the existing greenhouse.*

Site B had a moderate to slight slope that would require erosion control; had utility lines transecting the area; and the soil tested to also be suitable for a variety of plants, shrubs and trees.

Figure 5-11 *Site C- Facing Southeast looking back towards the back of the school in between the basketball court and large existing sewer drain.*

Site C had a moderate to poor drainage; major sewer drains/pipes transecting the area; and the soil was tested to be suitable for a wide variety of plants, shrubs, and trees. Site A was chosen as the most suitable garden site for a math garden.

Creative Inquiry and the Design Process

The students enrolled in the Creative Inquiry course at Clemson met with me on a weekly basis for approximately one hour. The professor of the course served as a mediator during the semester and allowed me to use the students for weekly focus groups, where I would help guide the students through the participatory design process of designing and implementing the math garden.

Figure 5-12 *Weekly meetings with the Creative Inquiry students help to develop ideas for a concept math garden design for Dacusville Middle School*

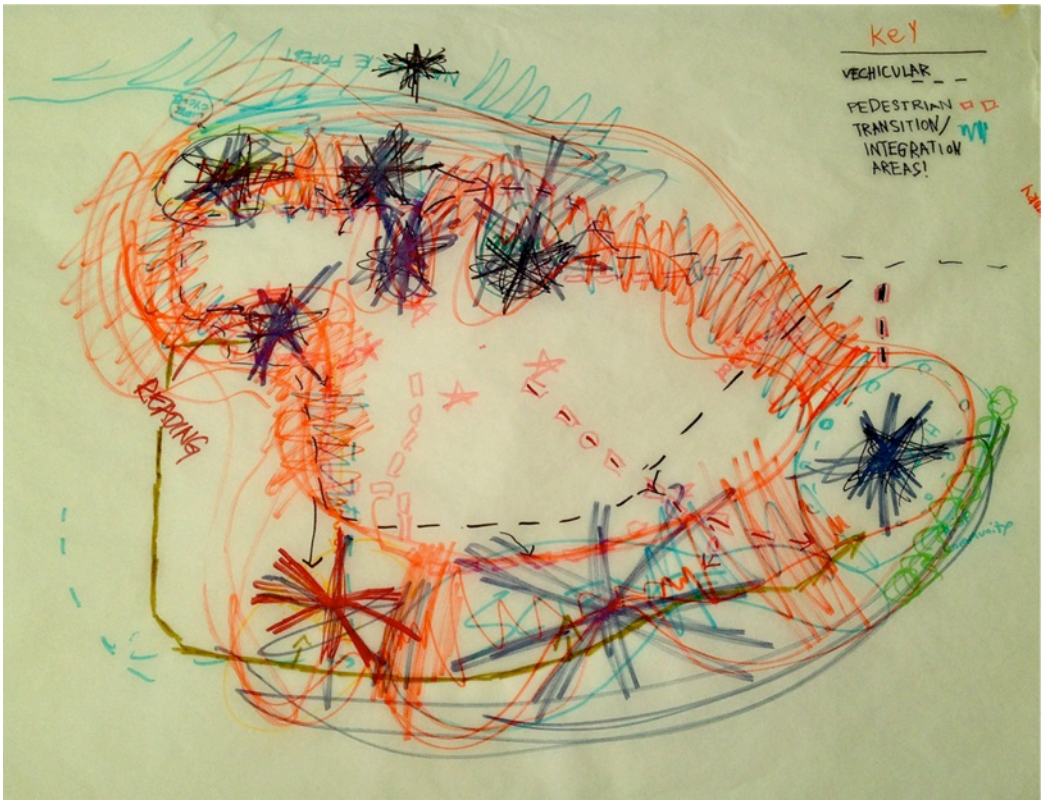


Figure 5-13 *Example of one of the weekly sketches students generated to help find locations for different elements within the math garden* (Image credit: CU Creative Inquiry students)

Along with using the guidelines previously set up, I helped the students generate ideas for designs, focused on areas needing further development, and addressed any concerns and/or issues that they had during this process. A loose set of design requirements was set-up for the students to help them address the design guidelines and they were each asked to generate a concept math garden design. These design requirements were:

- Concept garden designs must fit within the area designated by the site analysis
- Designs must use or address the use of loose parts
- Designs must provide multi-functional spaces for learning math concepts
- The use of plants and seating should in incorporated in the design

A conceptual math garden was created from all of the ideas generated by the students in the Creative Inquiry course, which would be presented to the school for approval.

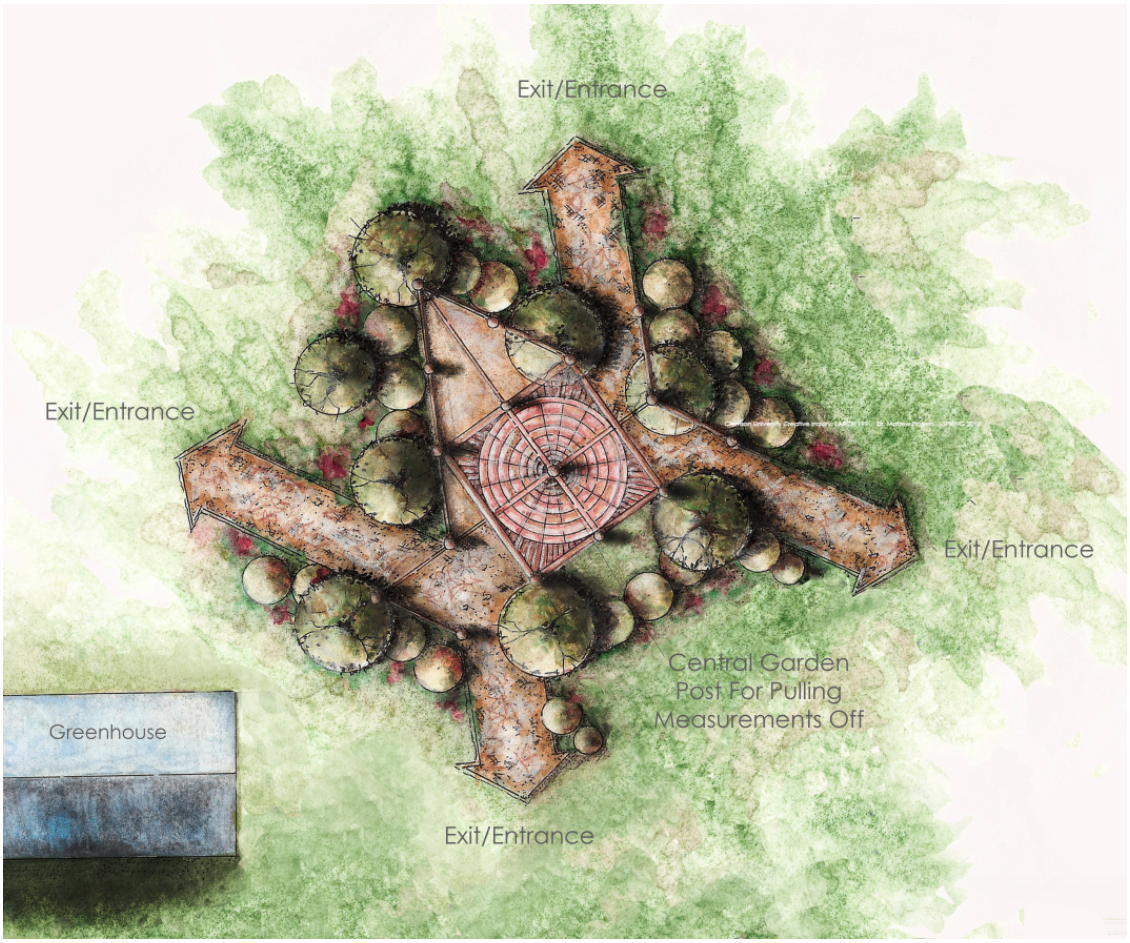


Figure 5-14 *The preliminary conceptual math garden design presented to the faculty at Dacusville Middle School for approval*

By using the elements and concepts discussed previously in this study an overall conceptual master plan was developed for the entire campus of Dacusville Middle School. We presented this initial math garden design in a presentation to the teachers and used their feedback to further refine the design and address an issues or concerns that they had.

Figure 5-15

Figure 5-16

Figures 5-15 *Conceptual math garden design presentation to faculty at Dacusville Middle School.*

Figure 5-16 *Site revisions were made after receiving feedback from presentation such as size and adding additional seating.*

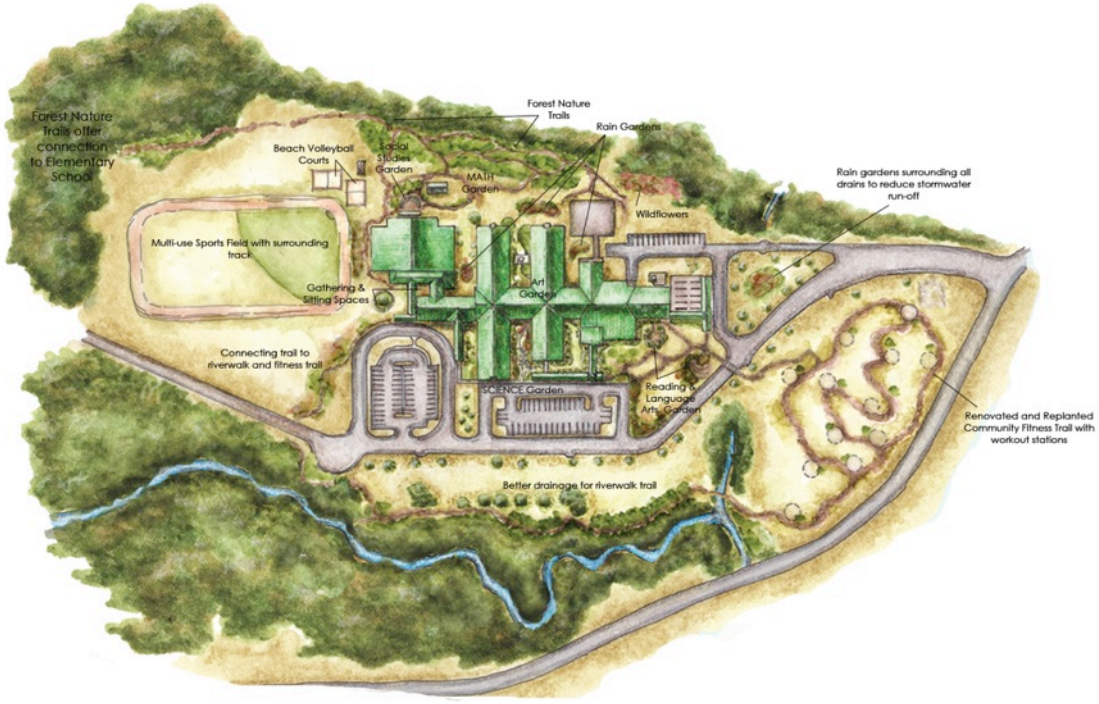


Figure 5-17 *A conceptual master plan was developed for the entire campus with additional learning gardens and other amenities located throughout the campus at Dacusville Middle School.*

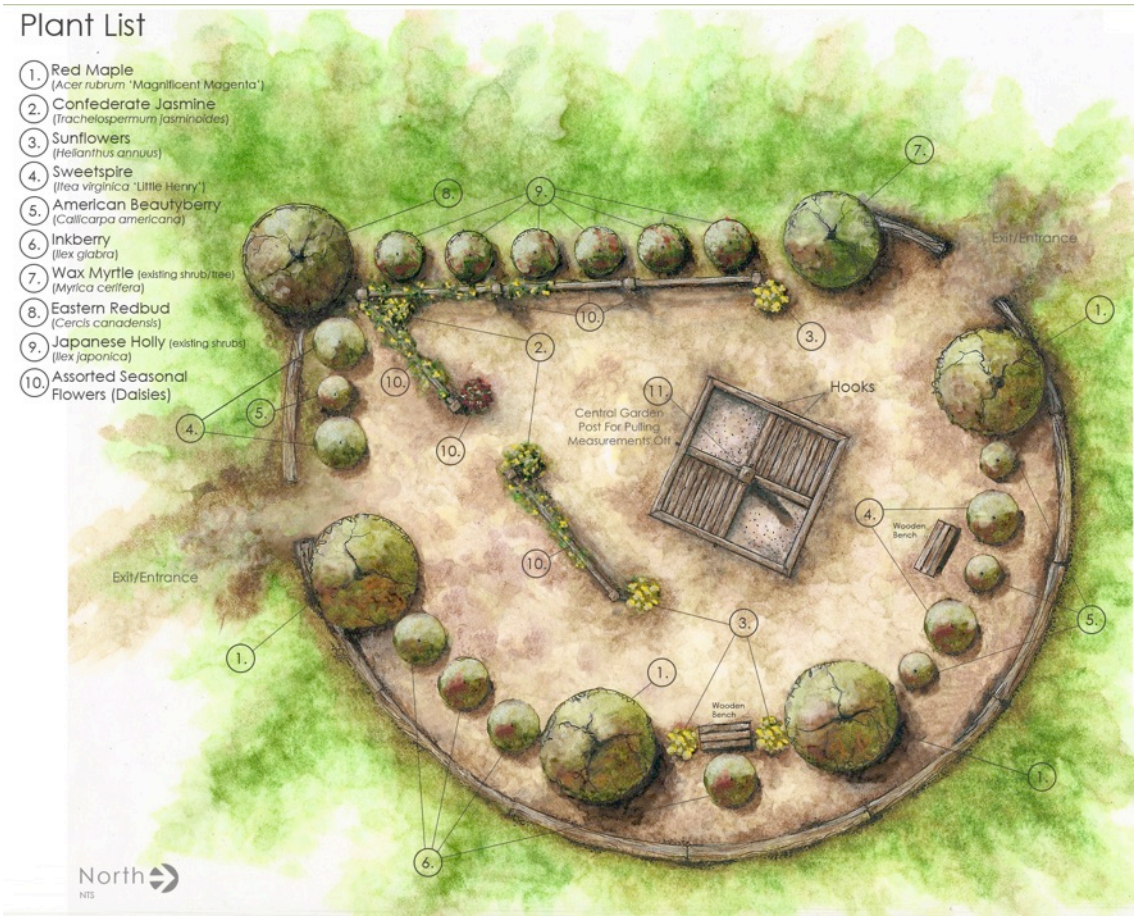


Figure 5-18 *The final master plan with planting details for the Dacusville Middle School math garden*

Figure 5-19

Figure 5-20

Figure 5-19 *The Dacusville Middle School math garden site before ground breaking*

Figure 5-20 *Implementation of the math garden began at the end of April 2012 and was completed by the first week in May 2012*


Figure 5-21


Figure 5-22


Figure 5-23


Figure 5-24

Figure 5-21 *through* **Figure 2-24** *Math garden construction*


Figure 5-25


Figure 5-26

Figure 5-25 *and* **Figure 2-26** *Math garden construction*


Figure 5-27


Figure 5-28

Figure 5-27 *and* **Figure 2-28** *Math garden construction*

Figure 5-29

Figure 5-30

Figure 5-31

Figure 5-29 *through* **Figure 2-31** *Math garden construction*

Figure 5-32

Figure 5-33

Figure 5-34

Figure 5-32 *through* **Figure 2-34** *Math garden construction*

When the math garden had neared the end of its construction phase we invited the students at Dacusville Middle School to help complete the finishing touches such as planting trees and seeds in the flowerpots. This is an important gesture for the math garden because it will give the students a sense of ownership to their garden. In return, they will have pride and help maintain the garden as it ages and they move from grade to grade. We taught the students how to care for the trees and gave them watering cans to water them on a daily basis as the new roots begin to grow.

Figure 5-35

Figure 5-36

Figure 5-35 *and* **Figure 5-36** *Students at Dacusville Middle School learn proper care of the trees and explore their new math garden*

Figure 5-37

Figure 5-38

Figure 5-37 *Students at Dacusville Middle School learn proper care of the trees and explore their new math garden*

Figure 5-38 *The finished math garden at Dacusville Middle School in 2012*

Figure 5-39 *The finished math garden at Dacusville Middle School in 2012*

CHAPTER SIX

FINAL CONCLUSIONS

The math garden succeeded in meeting all of the requirements set forth in the design guidelines that were established in this study. It has successfully achieved the three primary goals of creating an outdoor learning environment that provides opportunities for learning, while also using a participatory approach to the design process and construction of the garden. It has created connections for learning outside for the teachers of Dacusville Middle School and is the gateway garden for future gardens to be designed and installed at the school.

Figure 6-1 *The Dacusville Middle School math garden (six months after it's construction) serves a multi-purpose space. The school has enjoyed the use of the outdoor learning space for academic purposes and the students also enjoy the space for reading and socializing during recess and after school.*

Figure 6-2 *Students listening to instruction from their teacher on how to use the loose parts to complete a worksheet on Pythagorean theorem within the math garden at Dacusville Middle School.*

Figure 6-3 *Students choosing their preferred loose part from the box of materials provided. These items include synthetic and natural rope, plastic chains, flags, and tape measurers among other items.*

Figure 6-4 *Eighth grade math students using flags and plastic chains as loose parts to define a math worksheet. Loose parts allow the students to be creative and create solutions to the answers that relate best to them.*

Figure 6-5 *Eighth grade math students using Problem Based Learning principles within the math garden to help complete a worksheet on Pythagorean theorem*

Figure 6-6 *Eighth grade math students using the math garden. The students are only restricted by the limits of their imaginations on ways to create triangles with "loose parts" to help complete a worksheet on Pythagorean theorem.*

Lessons Learned

A little over 6 months have gone by and the math garden still looks nice and appears to be holding up to the use by the students. Reviews of the garden have been enthusiastic by both the teachers and the students. The students use the space outside of class as an area to gather to socialize and a place to read.

A few of the teachers feel a little overwhelmed on how to structure their classes to use the garden and have asked for a video showing how to use it. This idea takes away the creativity from the teachers, but might serve as a tool for them to become for accustomed to using the learning landscape.

APPENDICES

Appendix A - Student and Teacher Survey Forms

Survey for Teachers at Dacusville Middle School

1.) What is the most difficult concept for your students to understand?

2.) Are there any specific subjects and concepts that you feel could be explained and understood better through the outdoor landscape? If yes, what are a few?

3.) Do you plan your lessons solely on curriculum standards?

4.) If it were proven to be effective, would you teach from a "learning garden" on a consistent basis?

5.) Do you take your classes outside to help learn concepts? If yes, where do you usually take your students and what types of learning activities do you do?

6.) When you take your class outside, what are your biggest concerns?

Figure A-1 *Blank Teacher Survey*

Survey for Students at Dacusville Middle School

1. What activities do you like to do when you are playing outside?

2. What new features or activities would you like to have on the Dacusville Middle School campus?

3. What part of math is easiest for you? Why?

4. What part of math is hardest for you? Why?

5. If you were designing a math garden, what kinds of things do you think you would want to put into it? (CIRCLE ONE)
   1.) Water 4.) Seating
   2.) Vegetables/Edible Plants 5.) Movable Objects
   3.) Boulders/Rocks 6.) Other: _____
6. What type of games do you like to play outside? (CIRCLE ONE)
   1.) Four square 6.) Dodge Ball 11.) Other: _____
   2.) Hacky Sack 7.) Wall Ball
   3.) Frisbee 8.) Red Rover
   4.) Freeze Tag 9.) Jacks
   5.) Hopscotch 10.) Jump Rope Games

7. Gender (CIRCLE ONE): Male or Female
8. Year in school (CIRCLE ONE): 6th Grade, 7th Grade, 8th Grade

Figure A-2 *Blank Student Survey*

Appendix B - Survey Results Graphs

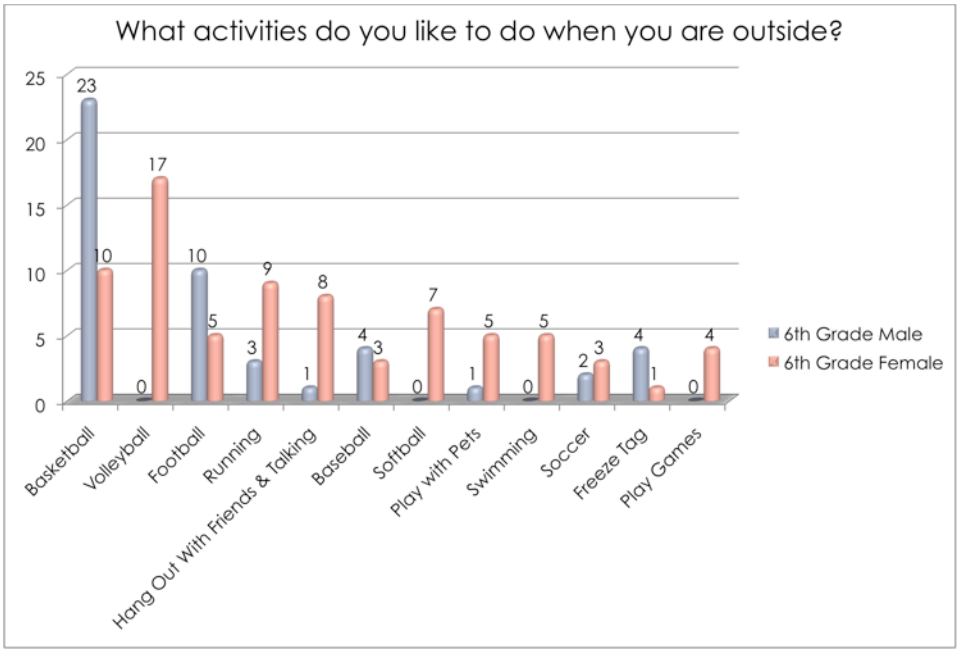


Figure B-1 *Question 1- 6th Grade Level Male and Female Responses and Totals*

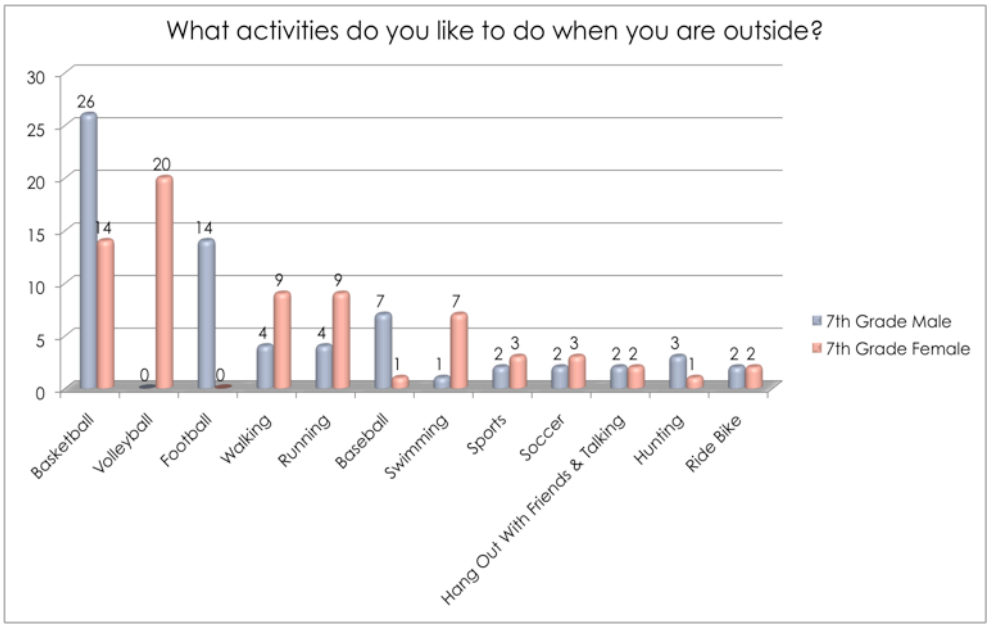


Figure B-2 *Question 1- 7th Grade Level Male and Female Responses and Totals*

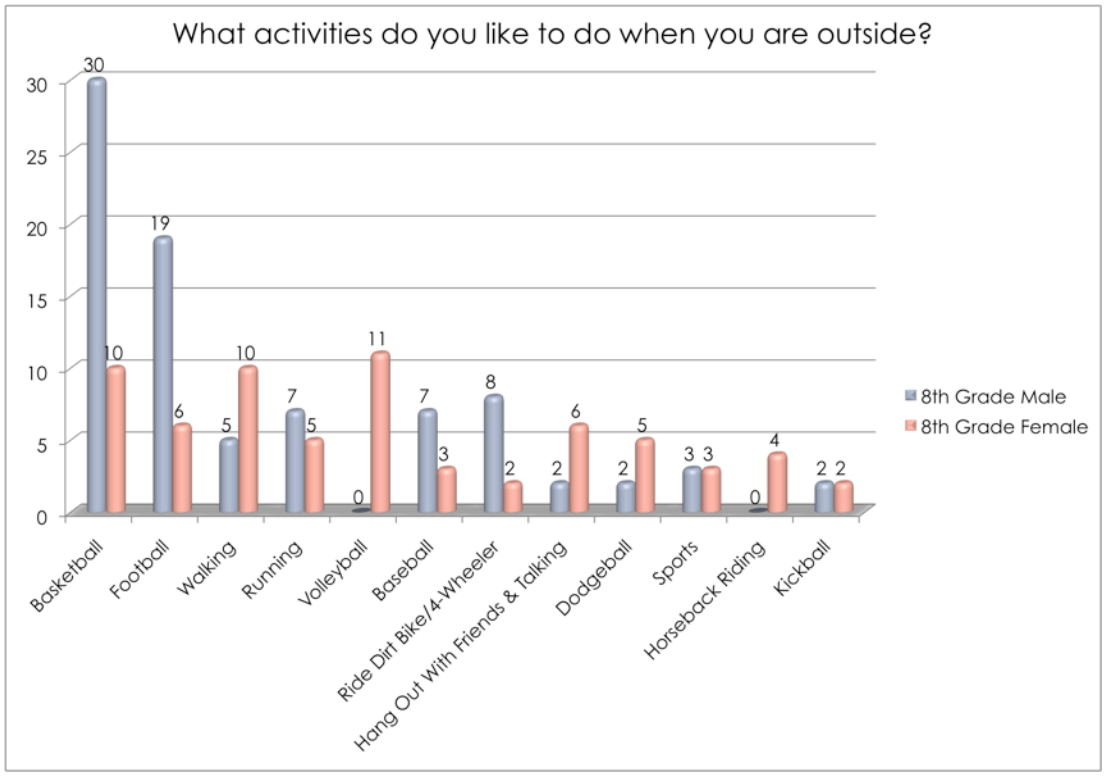


Figure B-3 *Question 1- 8th Grade Level Male and Female Responses and Totals*

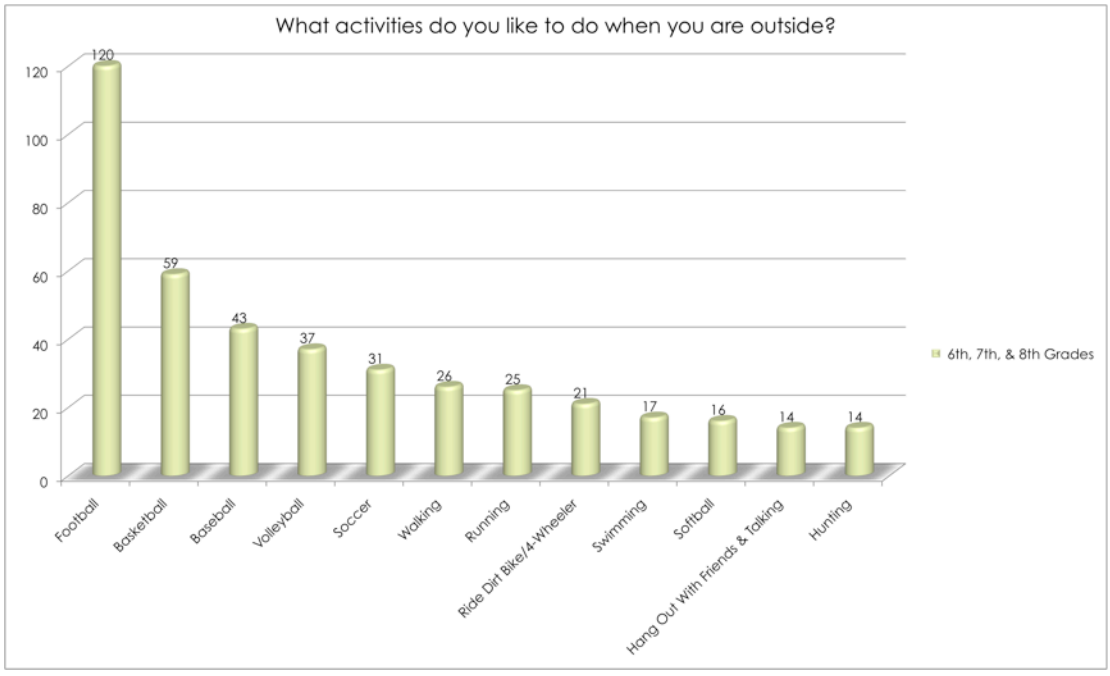


Figure B-4 *Question 1- All Grade Level Responses and Totals*

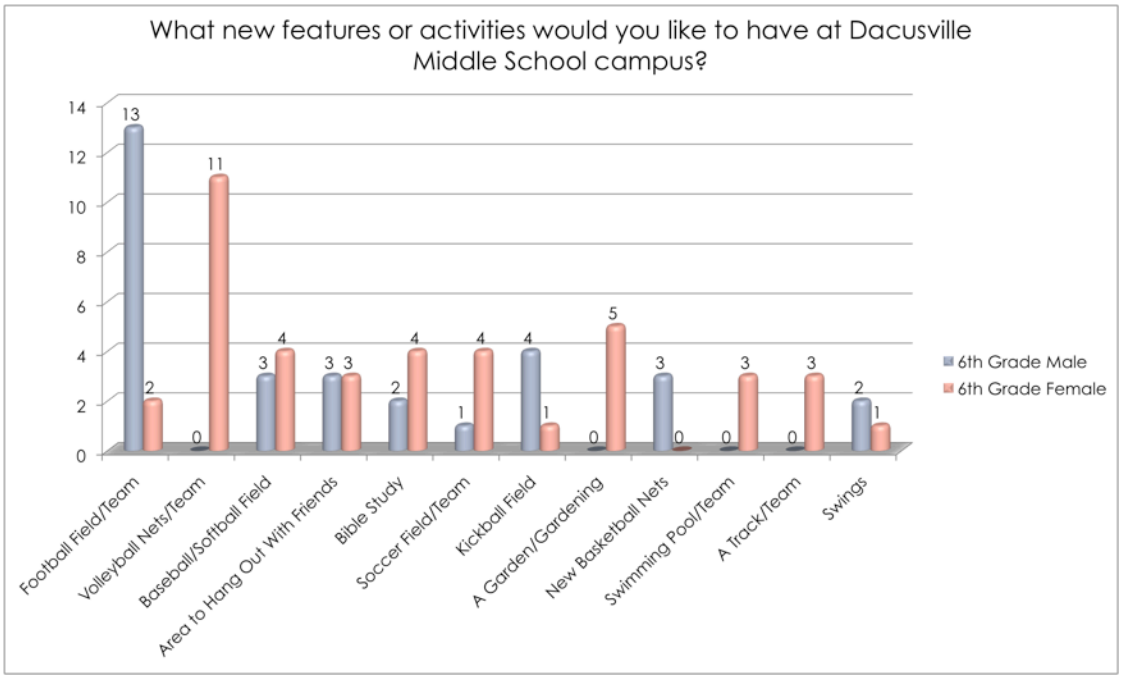


Figure B-5 *Question 2- 6th Grade Level Male and Female Responses and Totals*

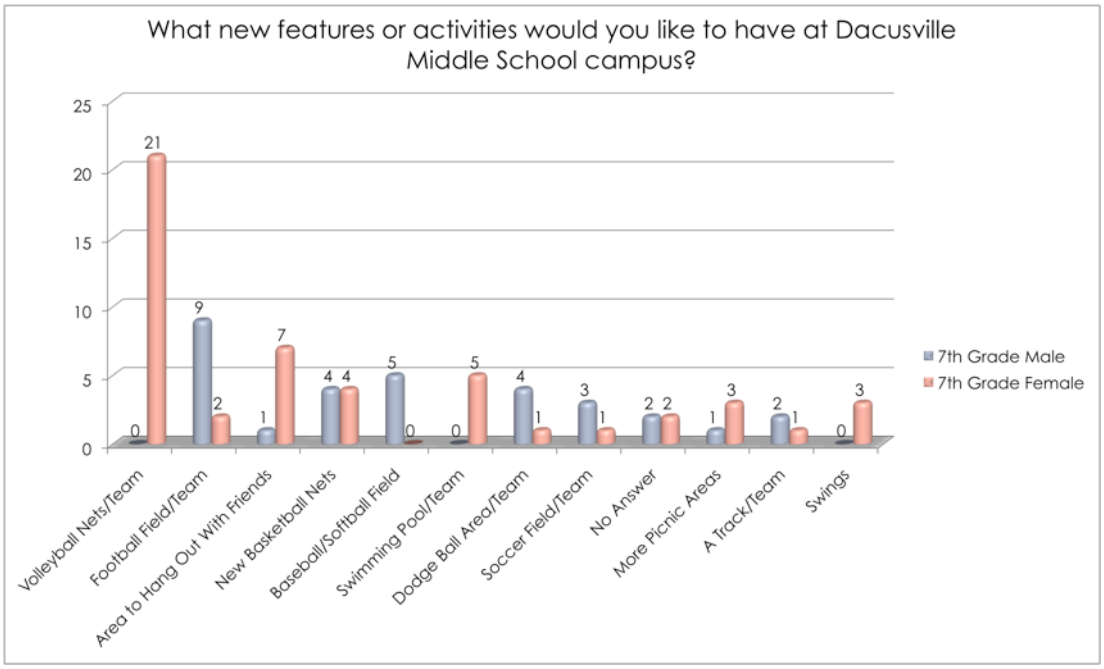


Figure B-6 *Question 2- 7th Grade Level Male and Female Responses and Totals*

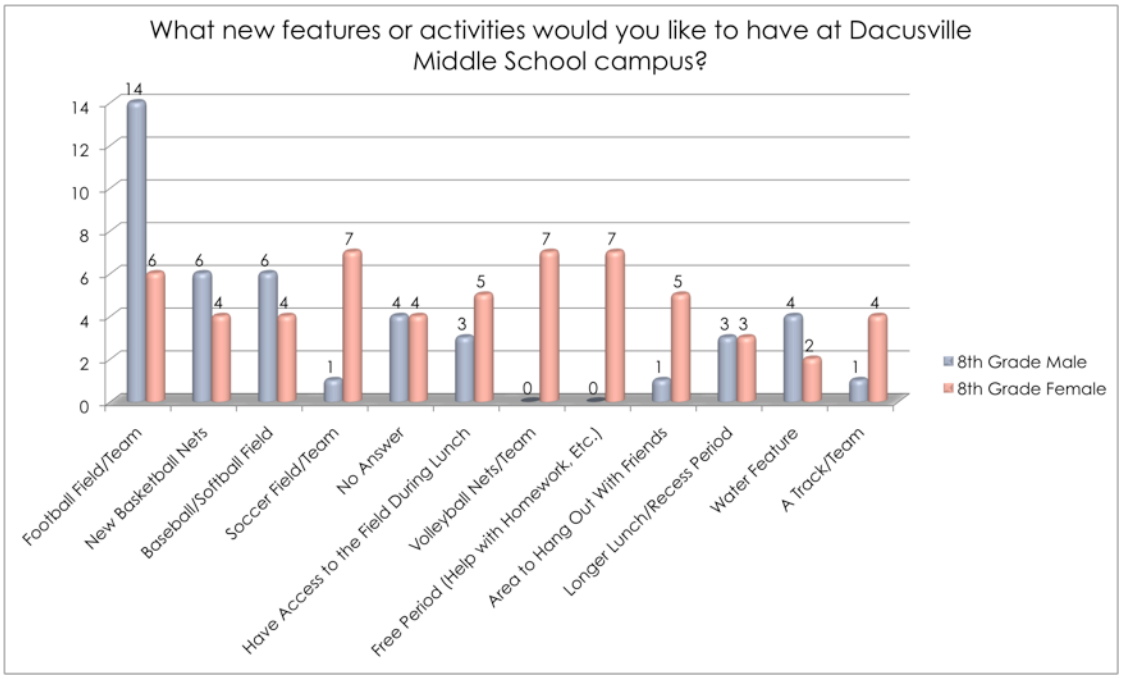


Figure B-7 *Question 2- 8th Grade Level Male and Female Responses and Totals*

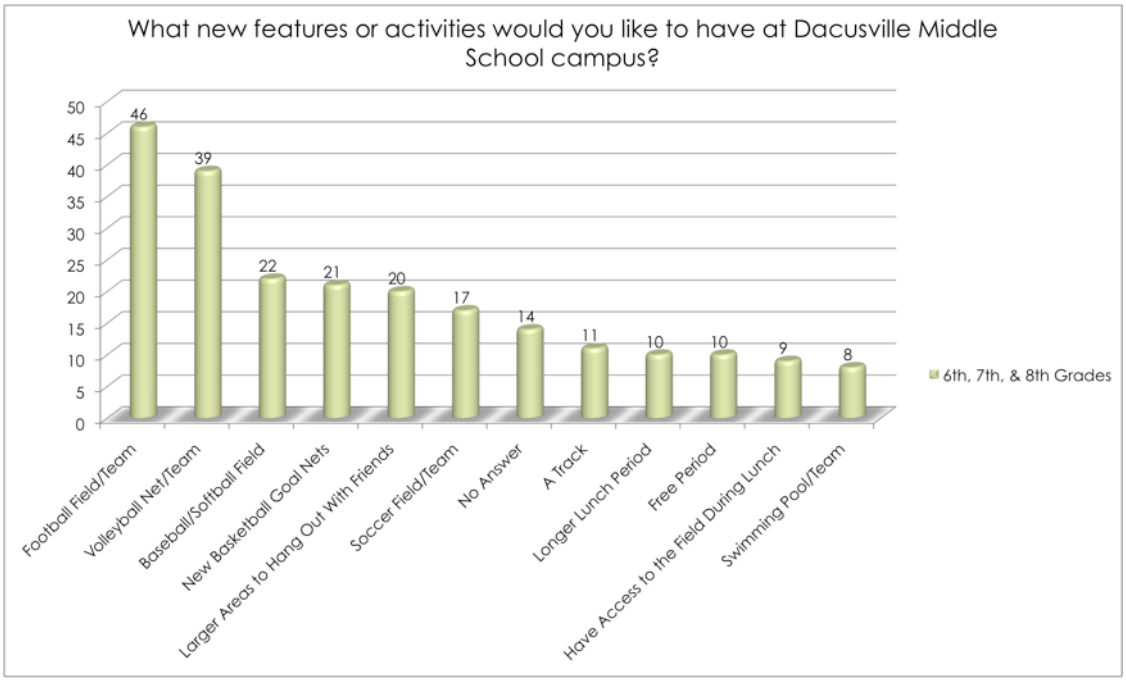


Figure B-8 *Question 2- All Grade Level Responses and Totals*

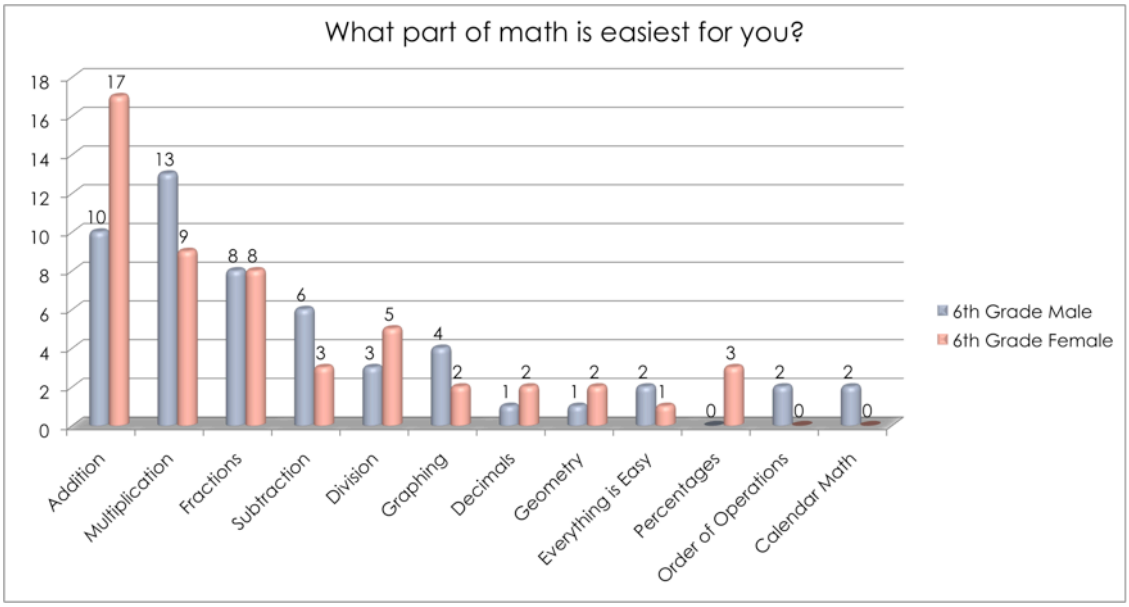


Figure B-9 *Question 3- 6th Grade Level Male and Female Responses and Totals*

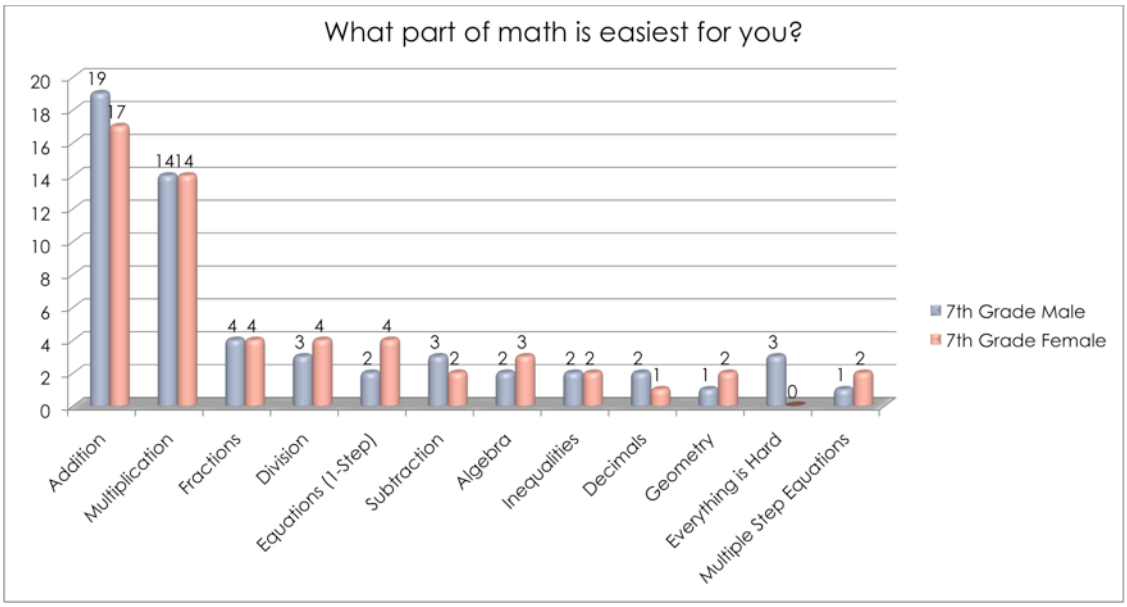


Figure B-10 *Question 3- 7th Grade Level Male and Female Responses and Totals*

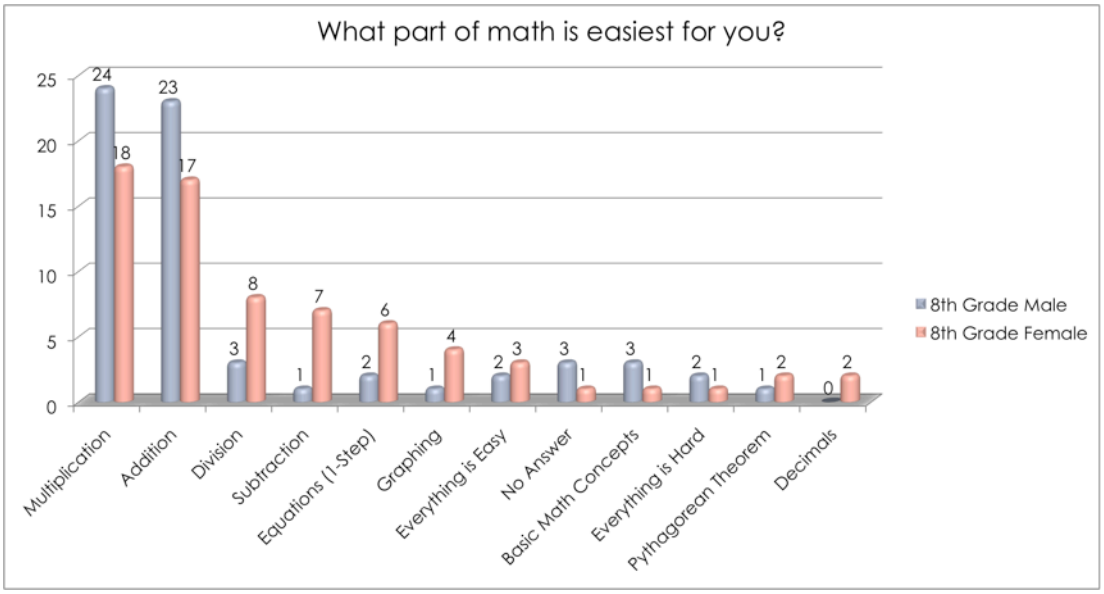


Figure B-11 *Question 3- 8th Grade Level Male and Female Responses and Totals*

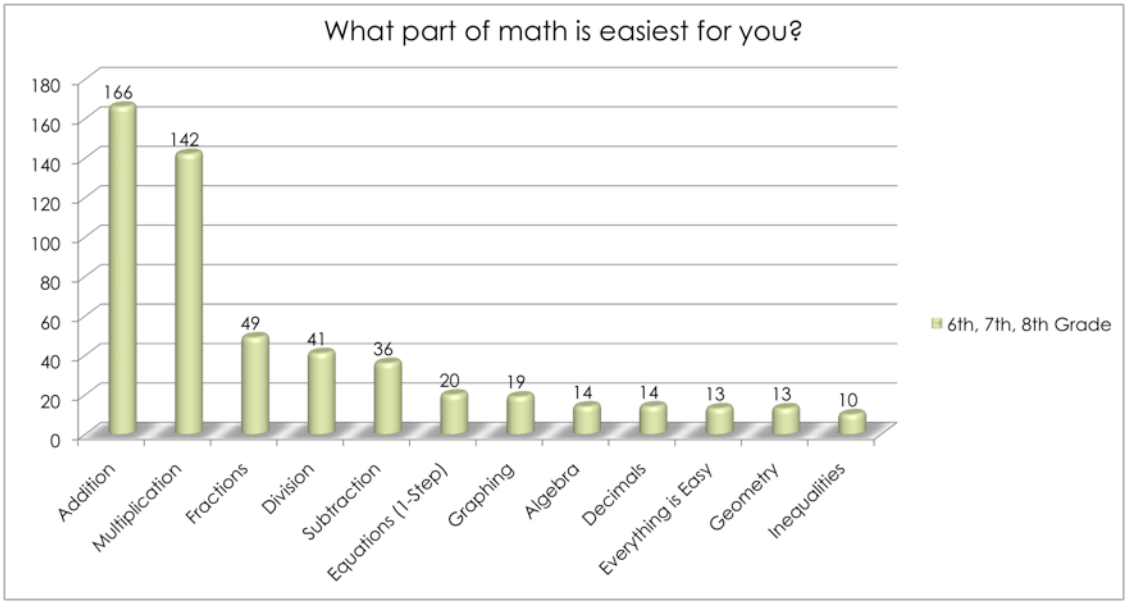


Figure B-12 *Question 3- All Grade Level Responses and Totals*

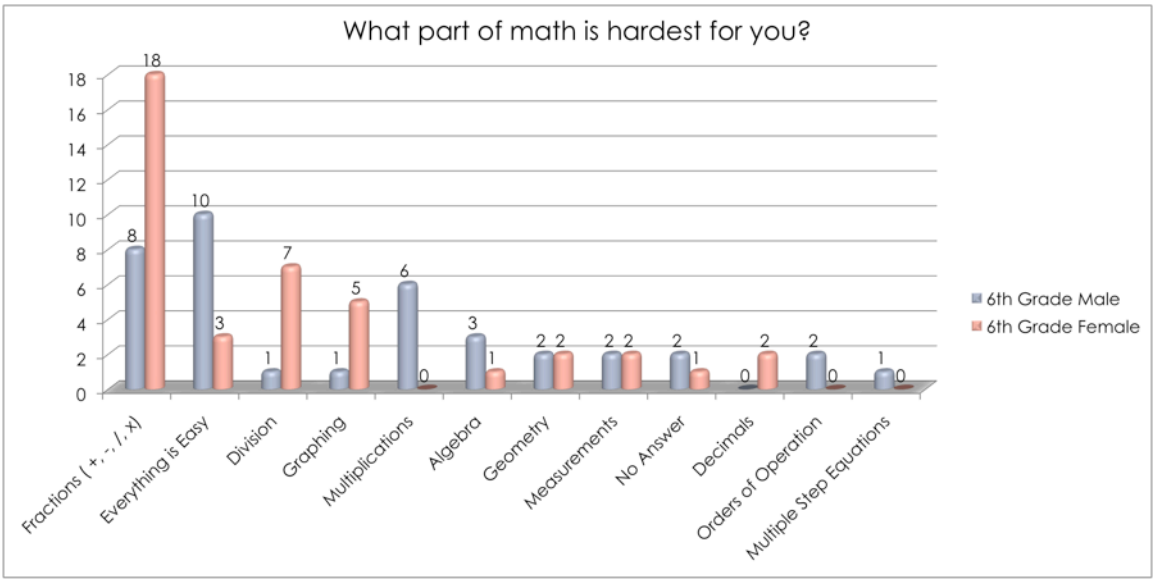


Figure B-13 *Question 4- 6th Grade Level Male and Female Responses and Totals*

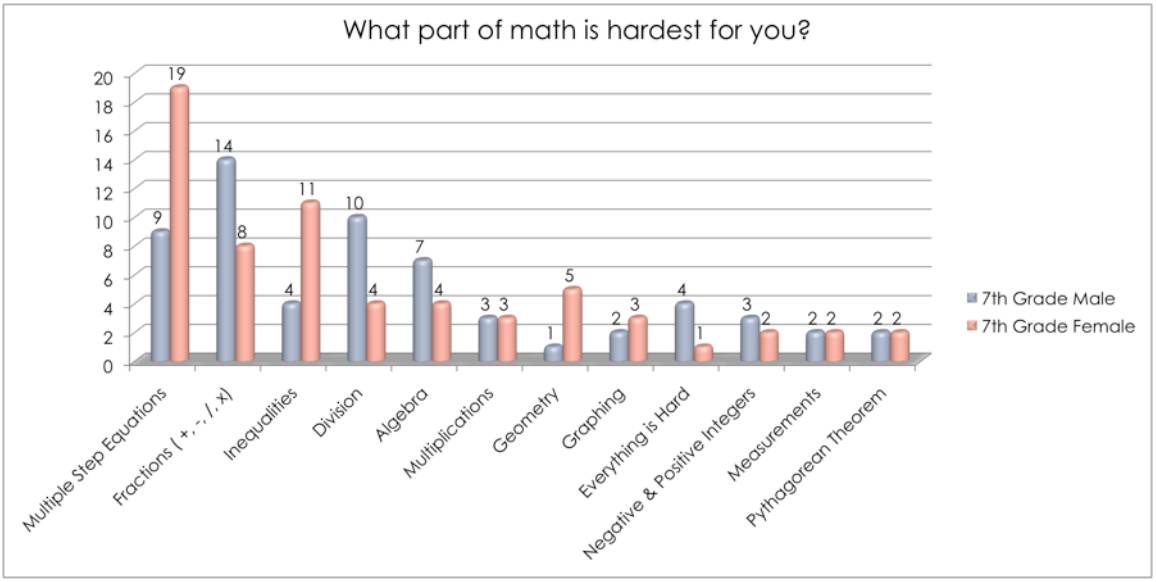


Figure B-14 *Question 4- 7th Grade Level Male and Female Responses and Totals*

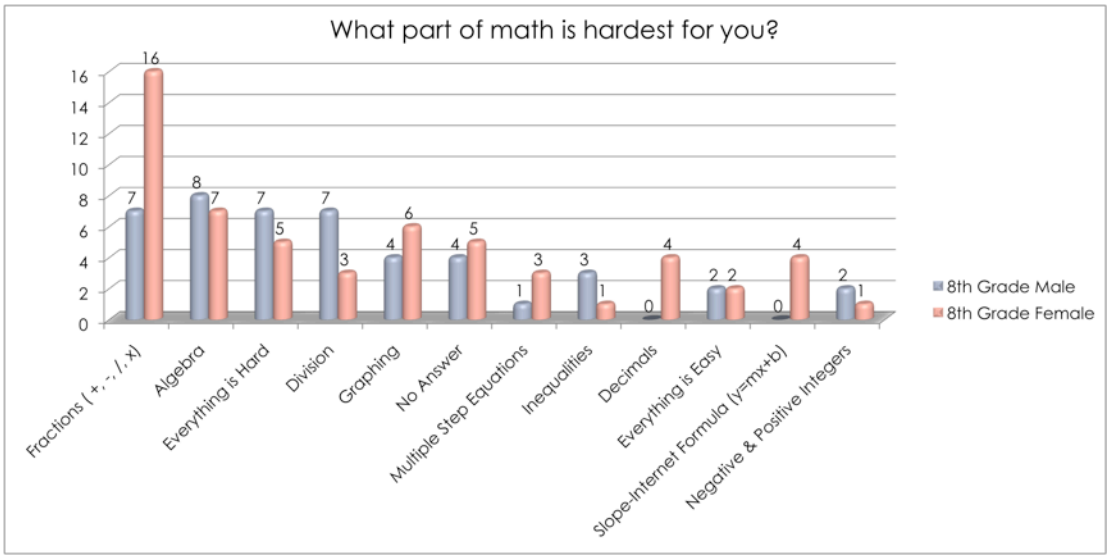


Figure B-15 *Question 4- 8th Grade Level Male and Female Responses and Totals*

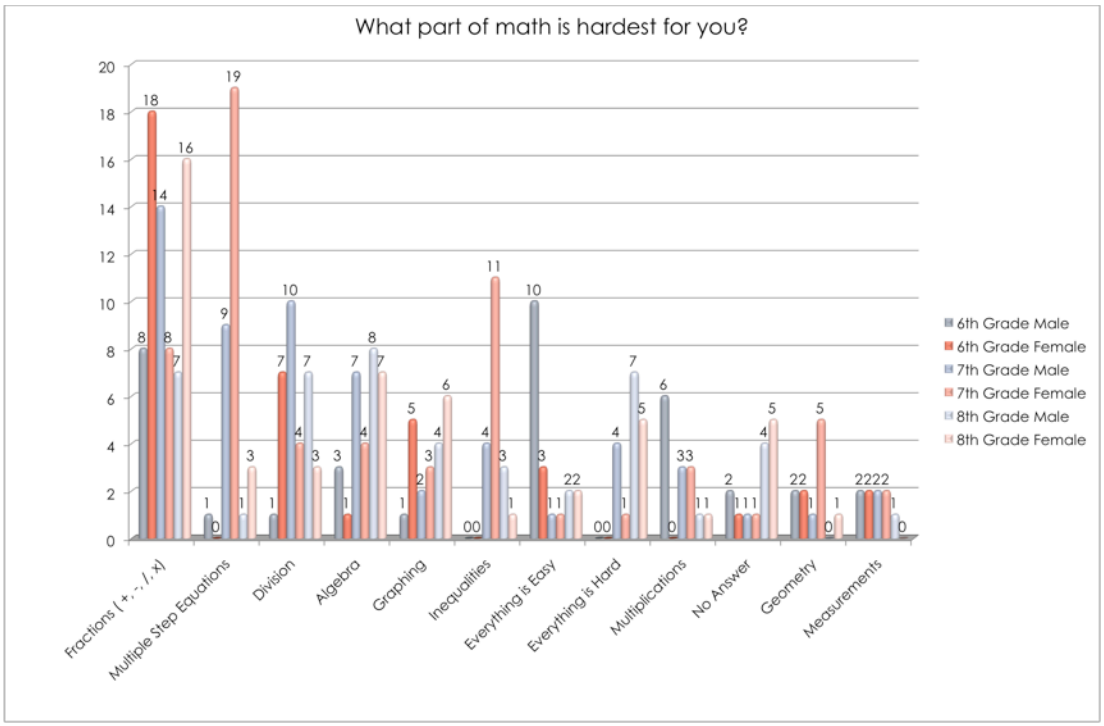


Figure B-16 *Question 4- All Grade Level Responses and Totals*

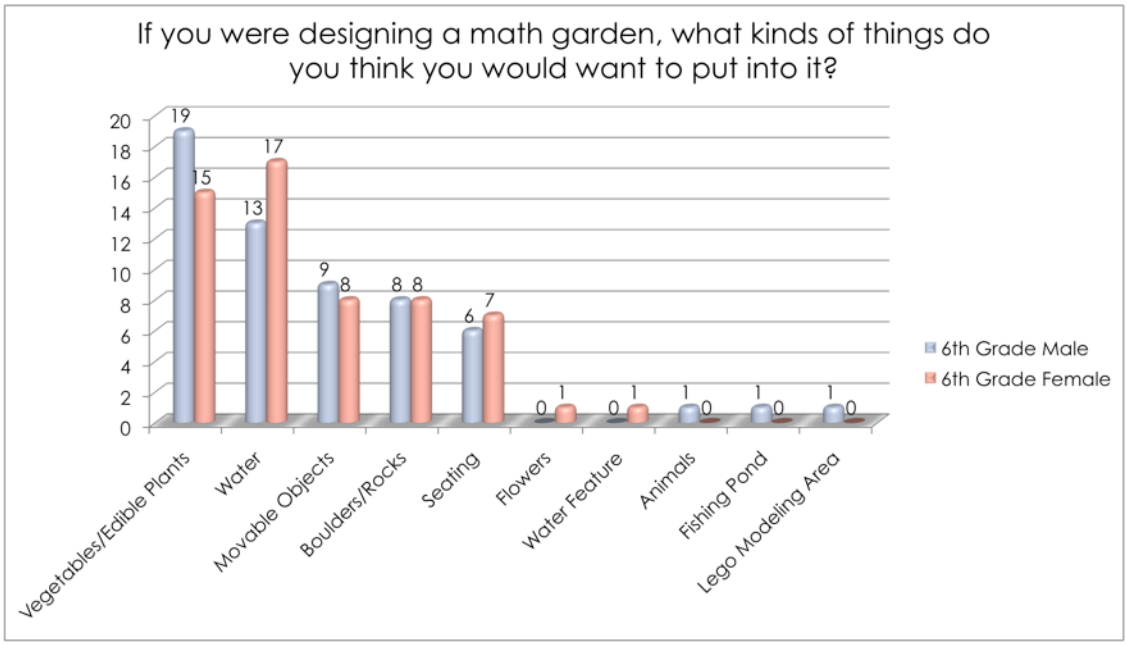


Figure B-17 *Question 5- 6th Grade Level Male and Female Responses and Total*

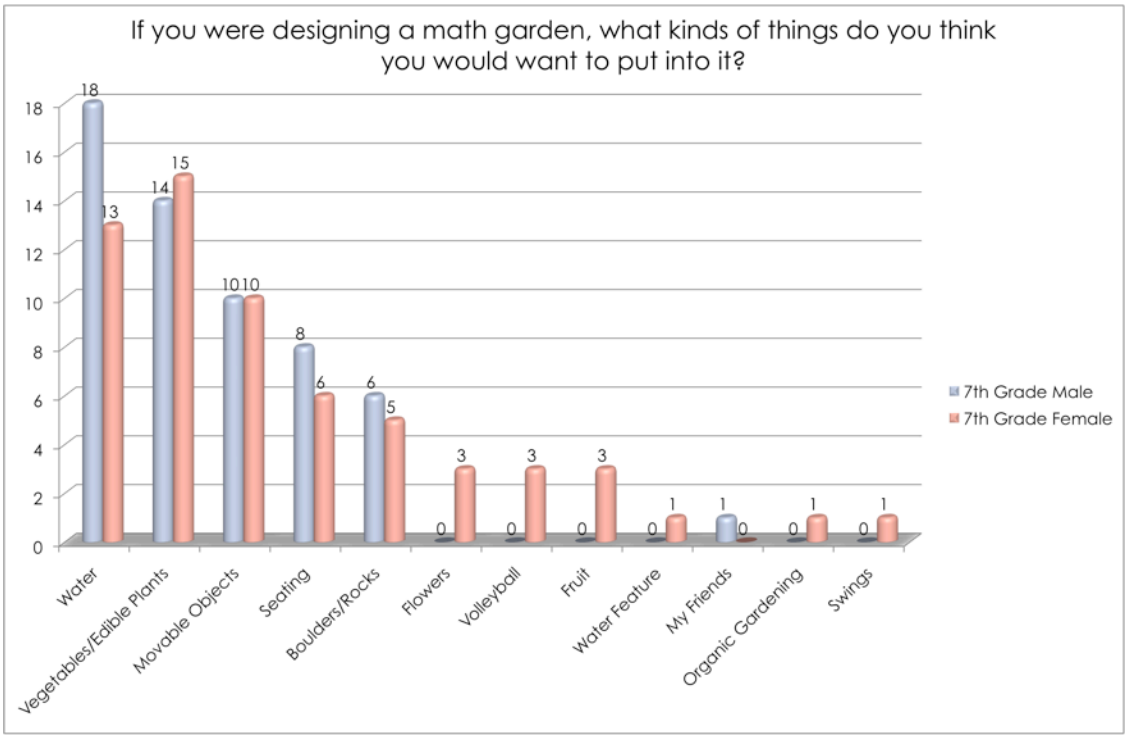


Figure B-18 *Question 5- 7th Grade Level Male and Female Responses and Totals*

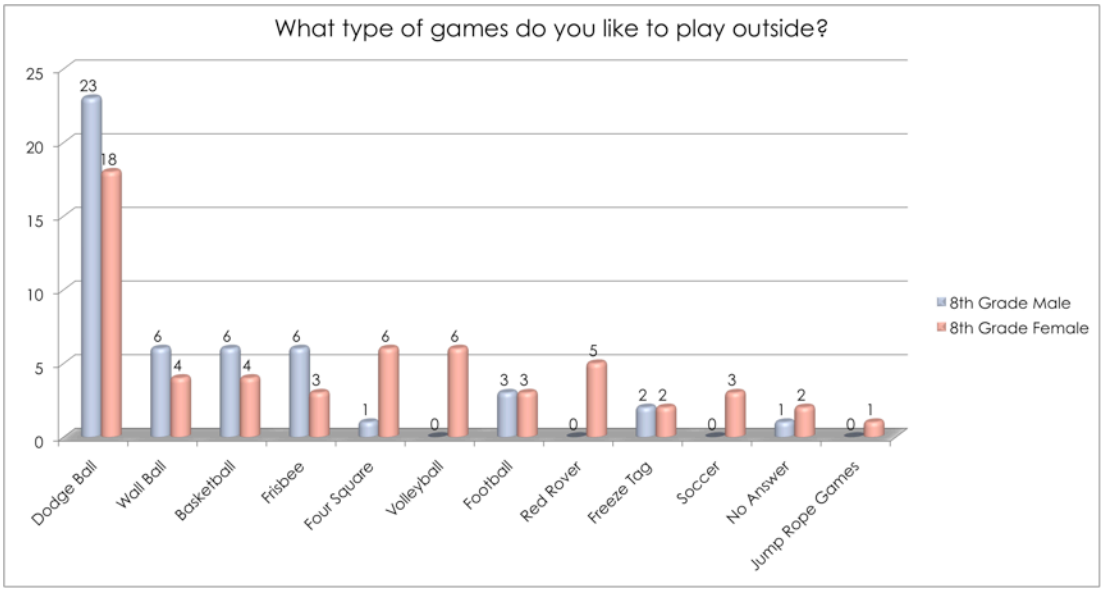


Figure B-19 *Question 5- 8th Grade Level Male and Female Responses and Totals*

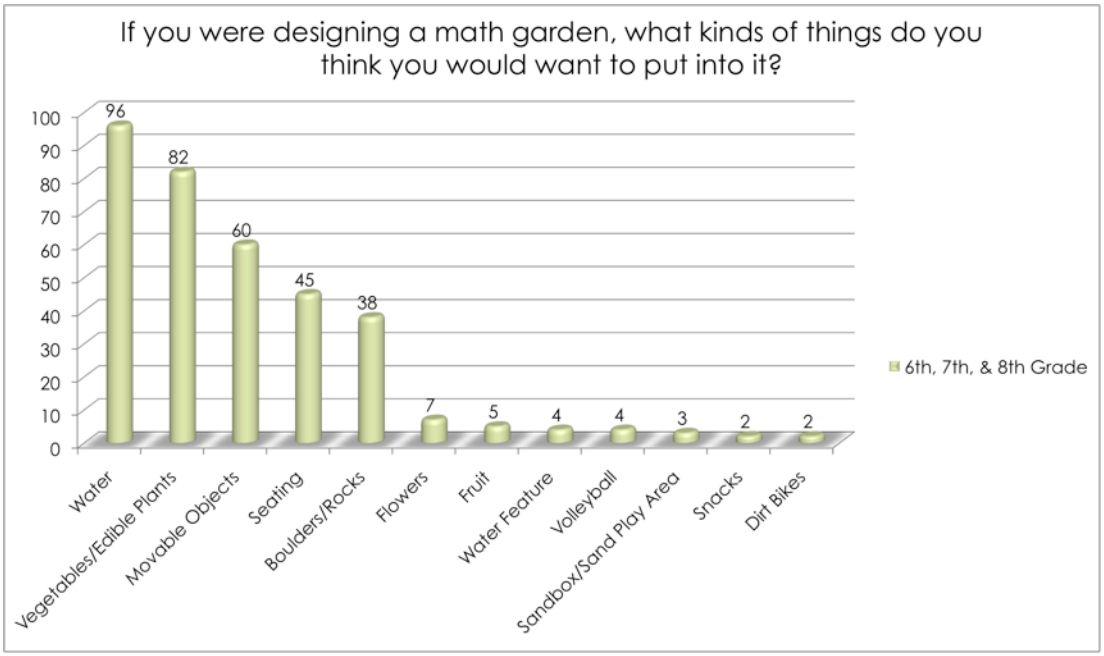


Figure B-20 *Question 5- All Grade Level Responses and Totals*

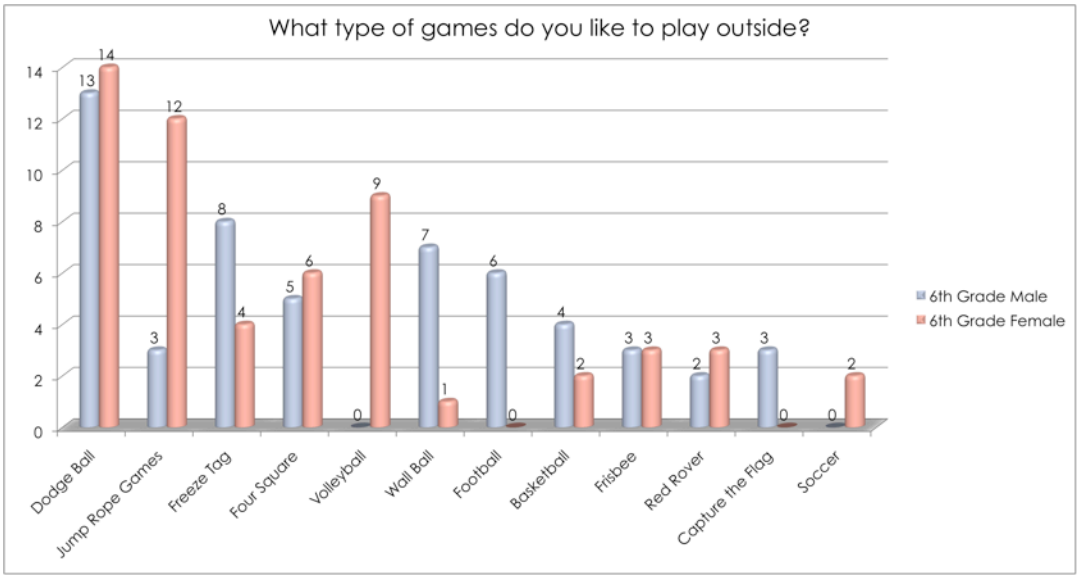


Figure B-21 *Question 6- 6th Grade Level Male and Female Responses and Totals*

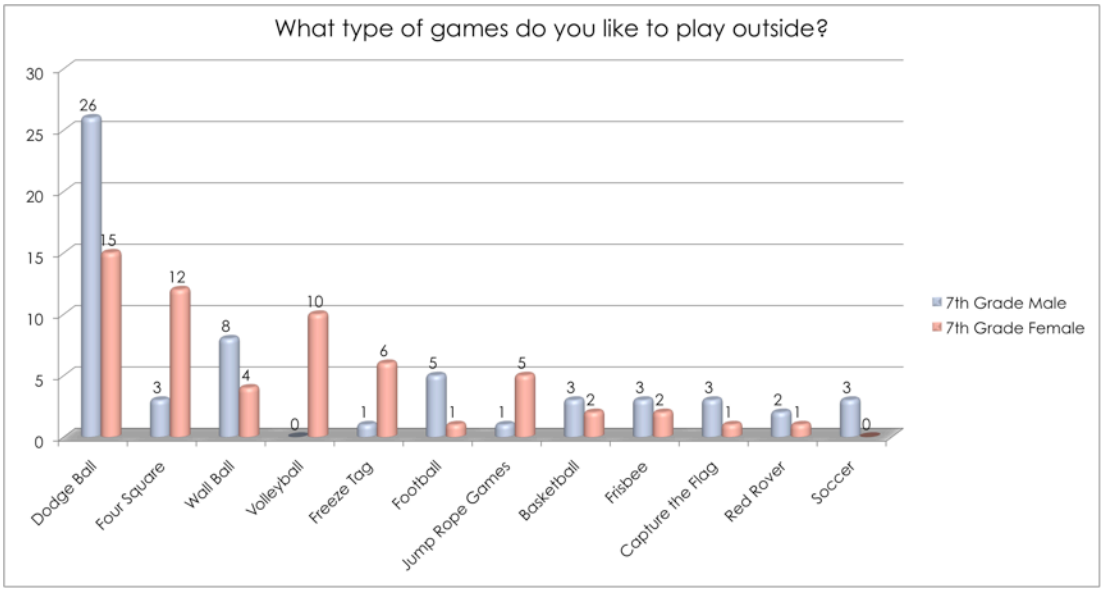


Figure B-22 *Question 6- 7th Grade Level Male and Female Responses and Totals*

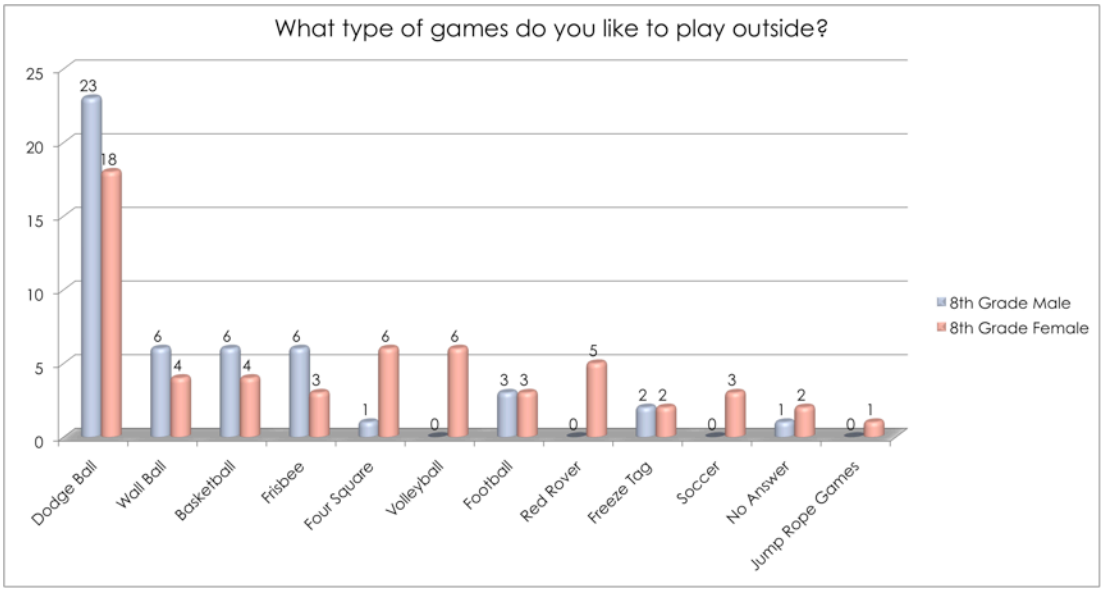


Figure B-23 *Question 6- 8th Grade Level Male and Female Responses and Totals*

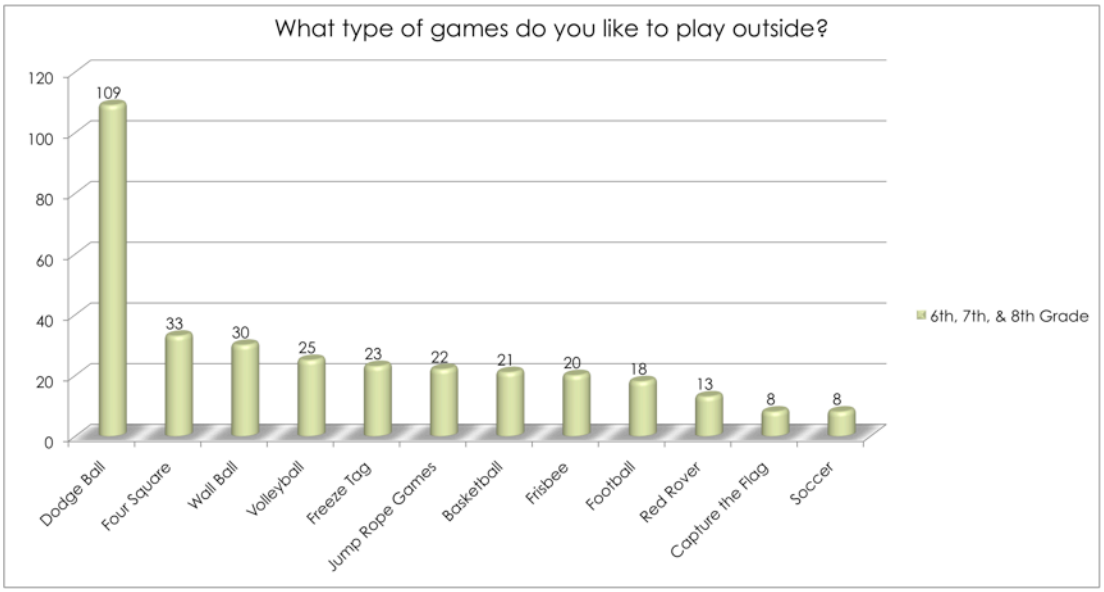


Figure B-24 *Question 6- All Grade Level Responses and Totals*

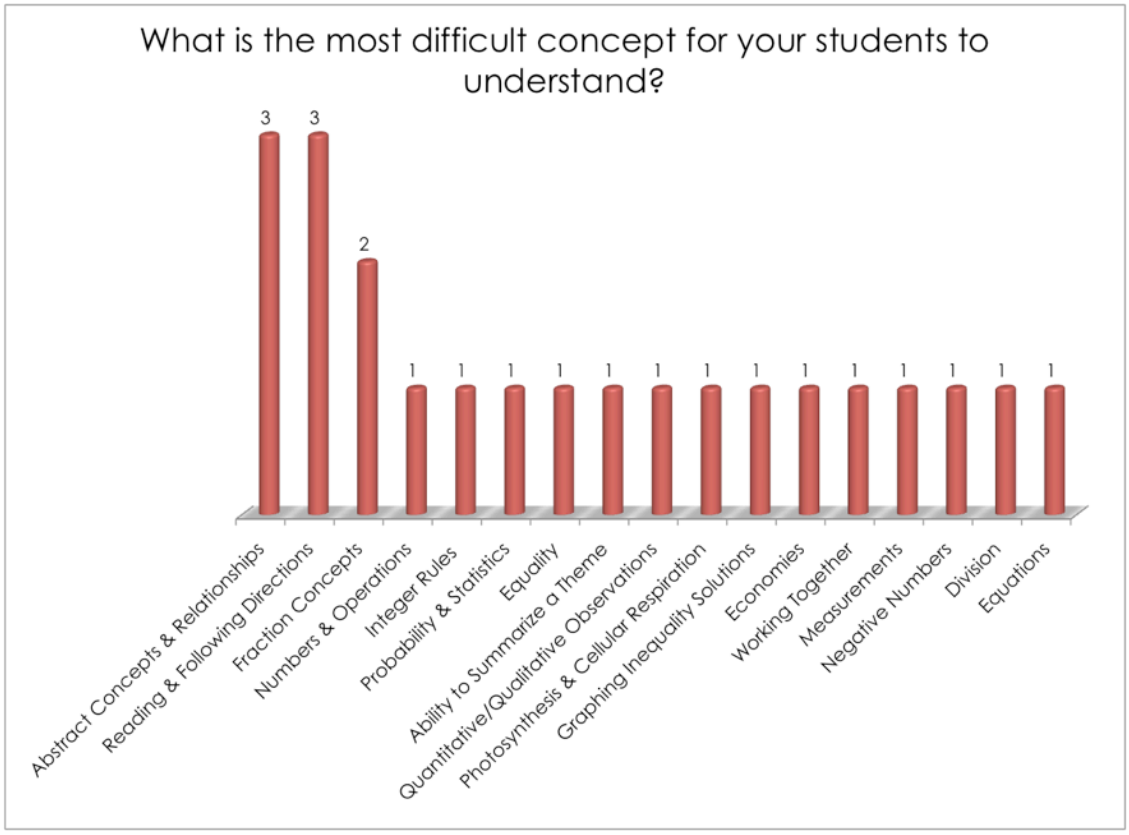


Figure B-25 *Question 1- Teacher Responses*

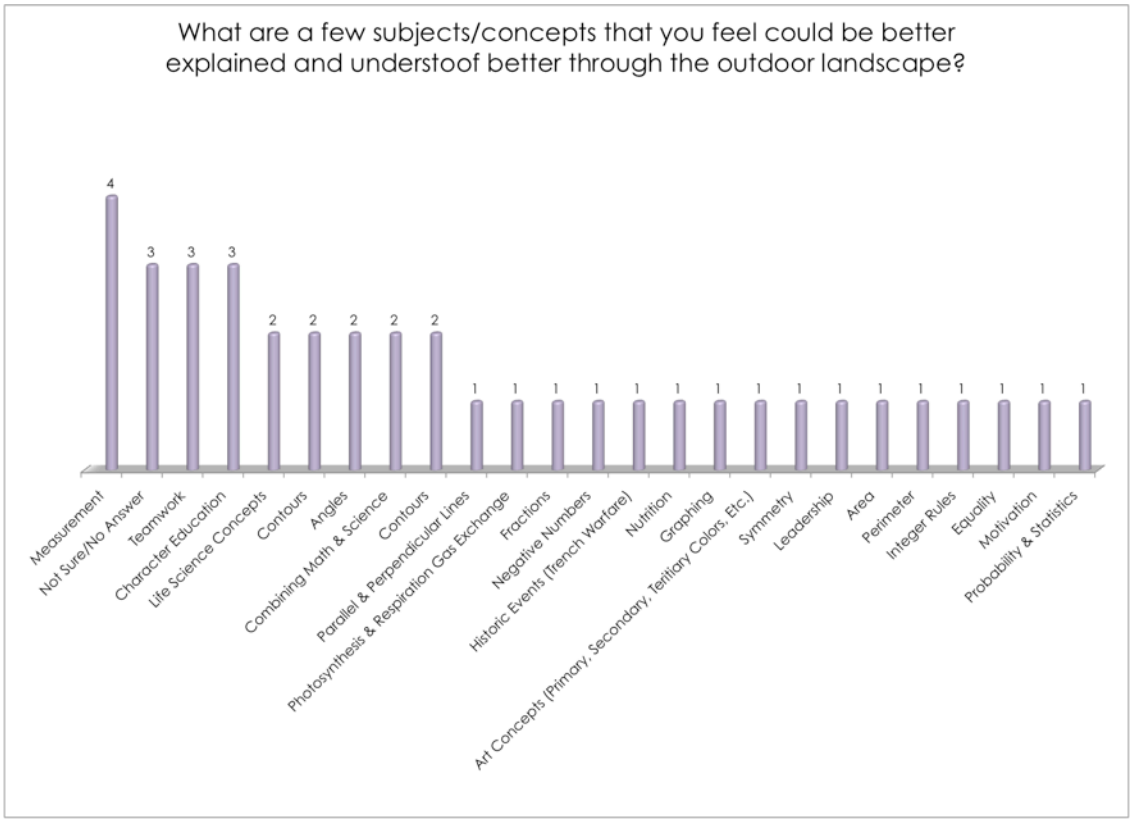


Figure B-26 *Question 2- Teacher Responses and Totals*

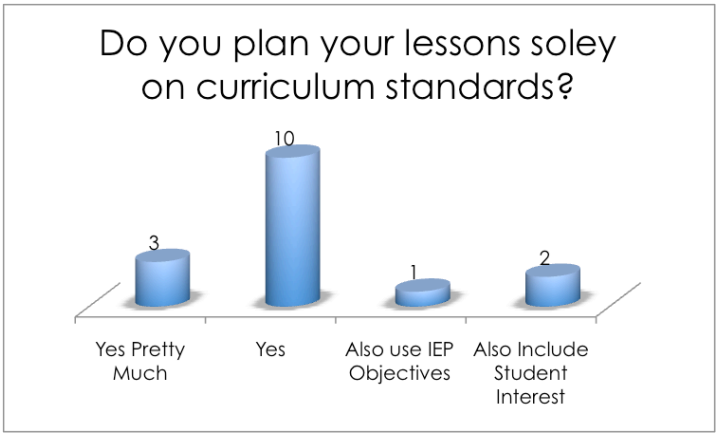


Figure B-27 *Question 3- Teacher Responses and Totals*

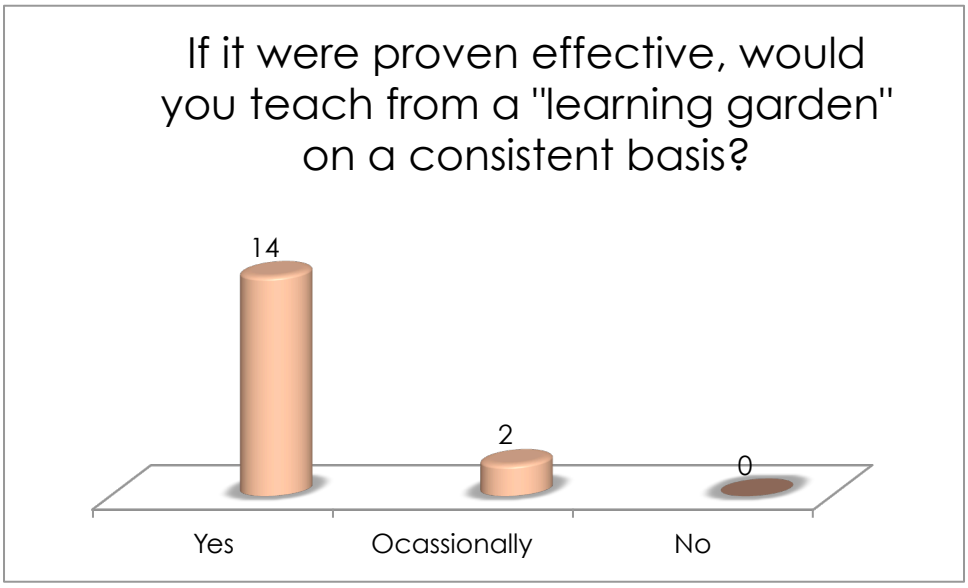


Figure B-28 *Question 4- Teacher Responses and Totals*

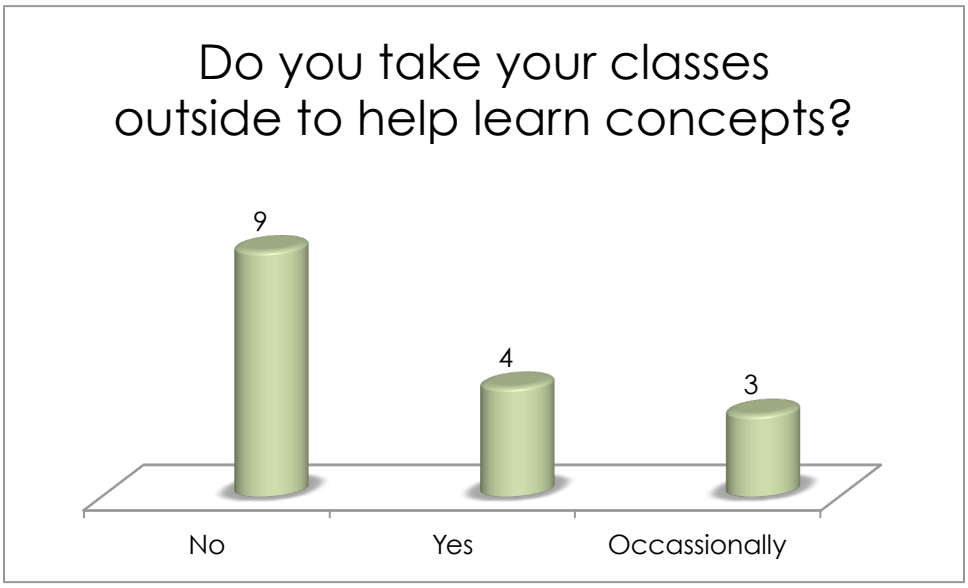


Figure B-29 *Question 5a- Teacher Responses and Totals*

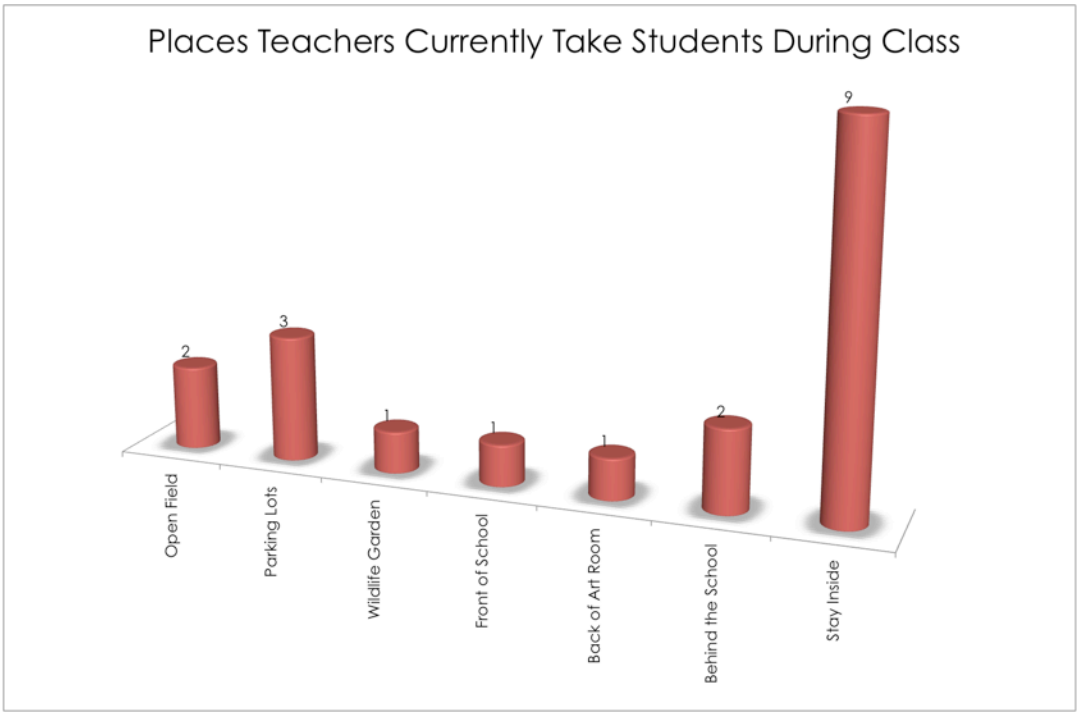


Figure B-30 *Question 5b- Teacher Responses and Totals*

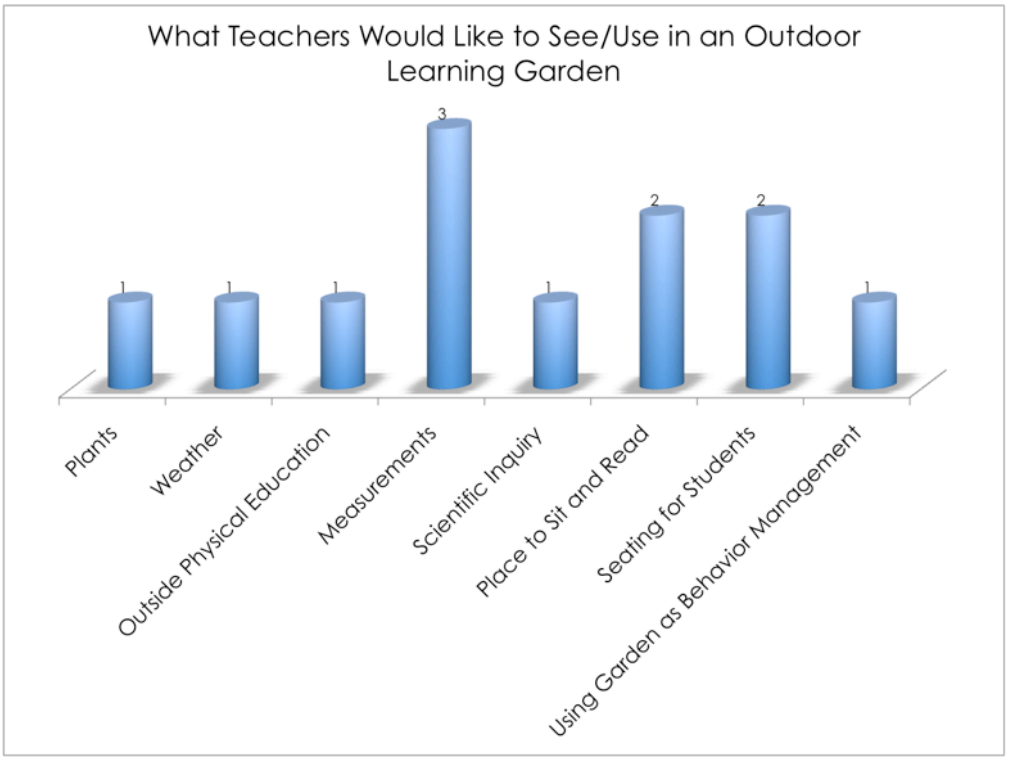


Figure B-31 *Question 5c- Teacher Responses and Totals*

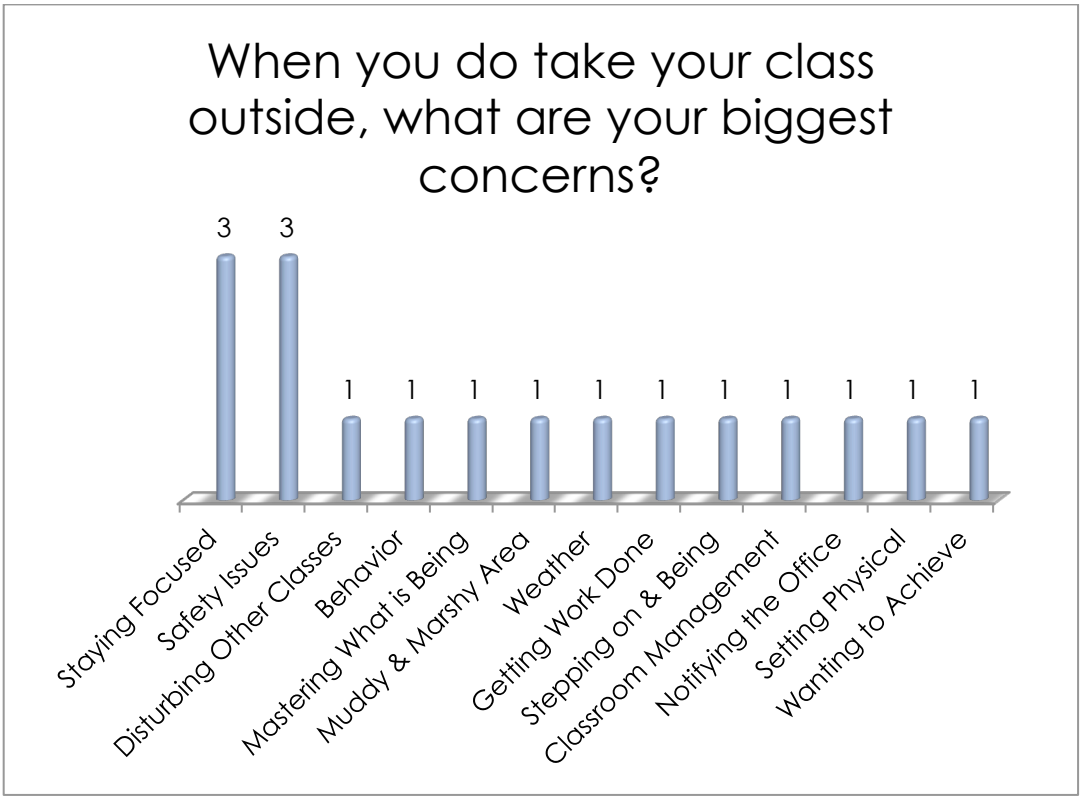


Figure B-32 *Question 6- Teacher Responses and Totals*

Appendix C - Presentation Boards

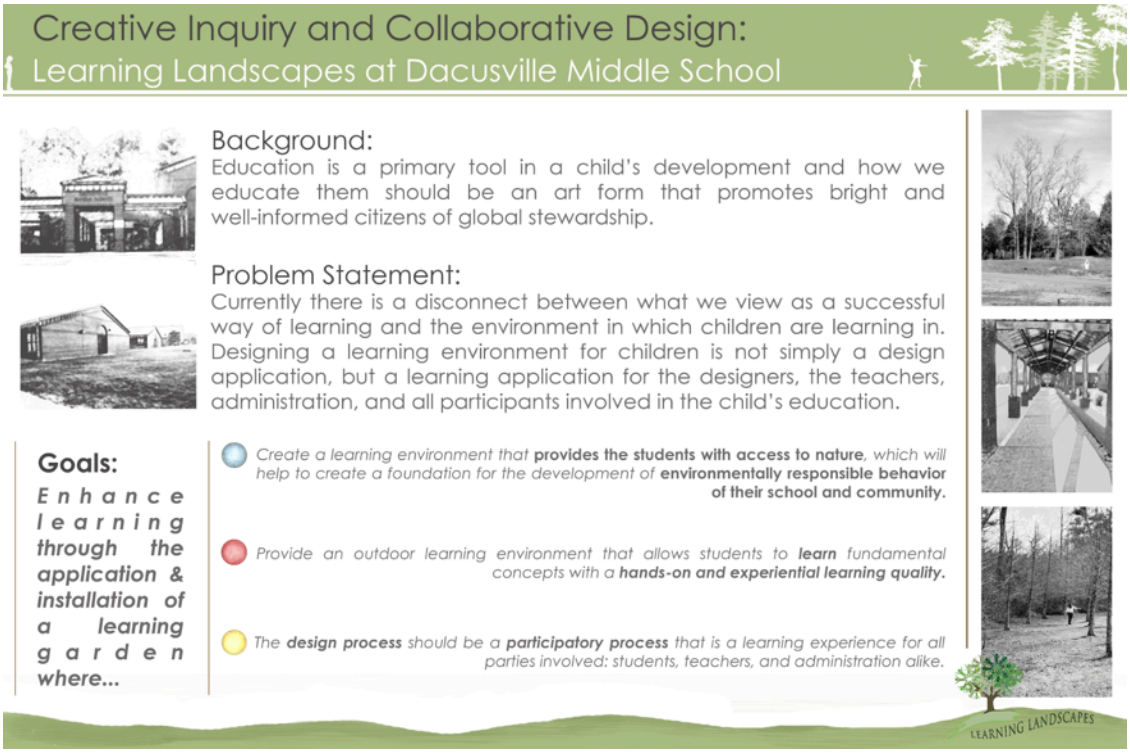


Figure C-1 *Background*

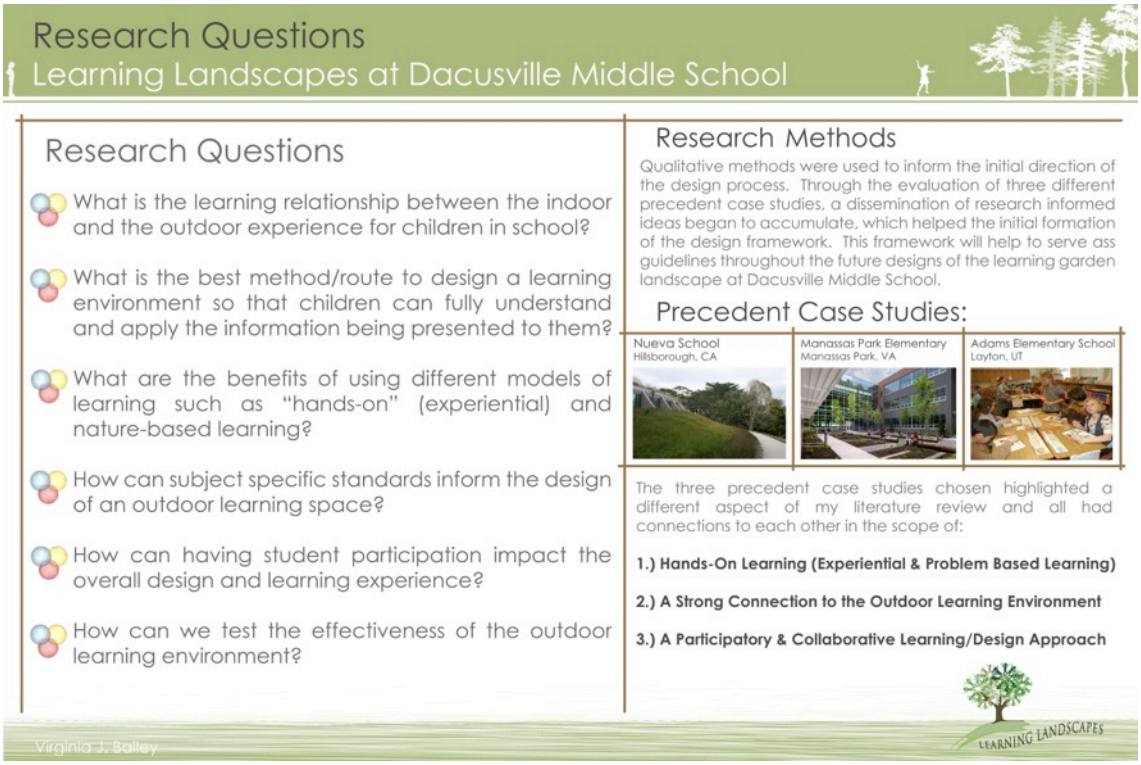


Figure C-2 *Research Questions*

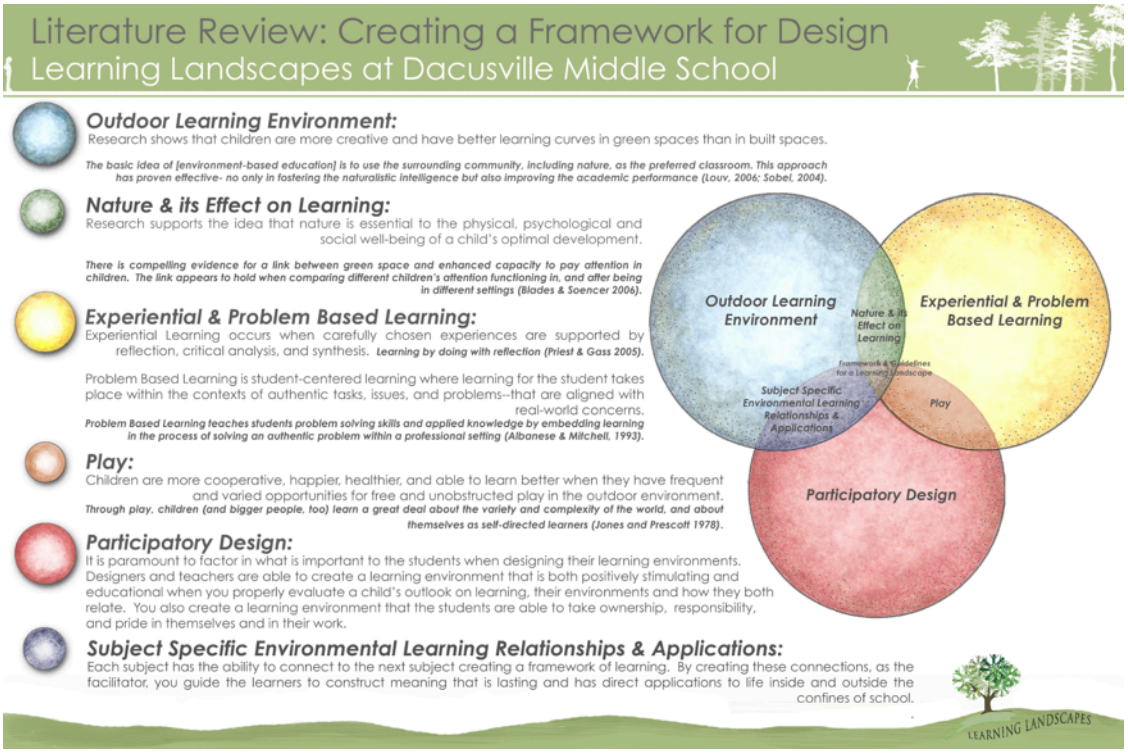


Figure C-3 *Literature Review*

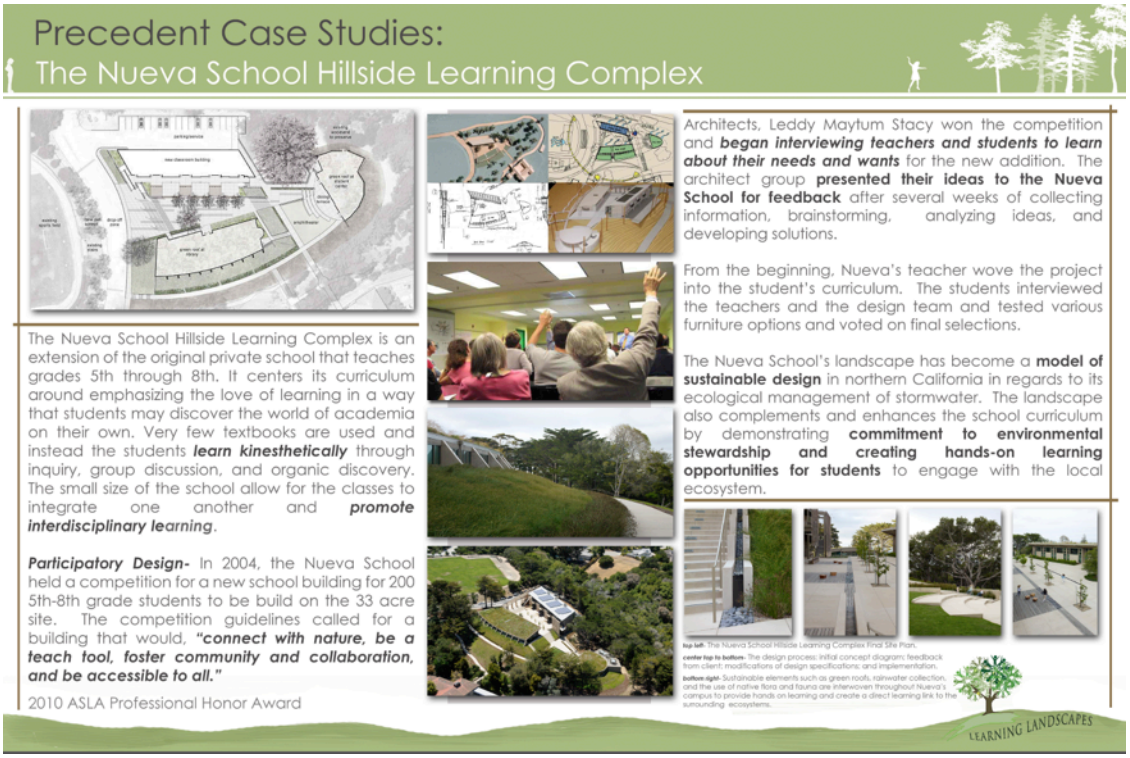


Figure C-4 *Precedent Study One- Nueva School*

Figure C-5 *Precedent Study Two- Manassas Park Elementary School*

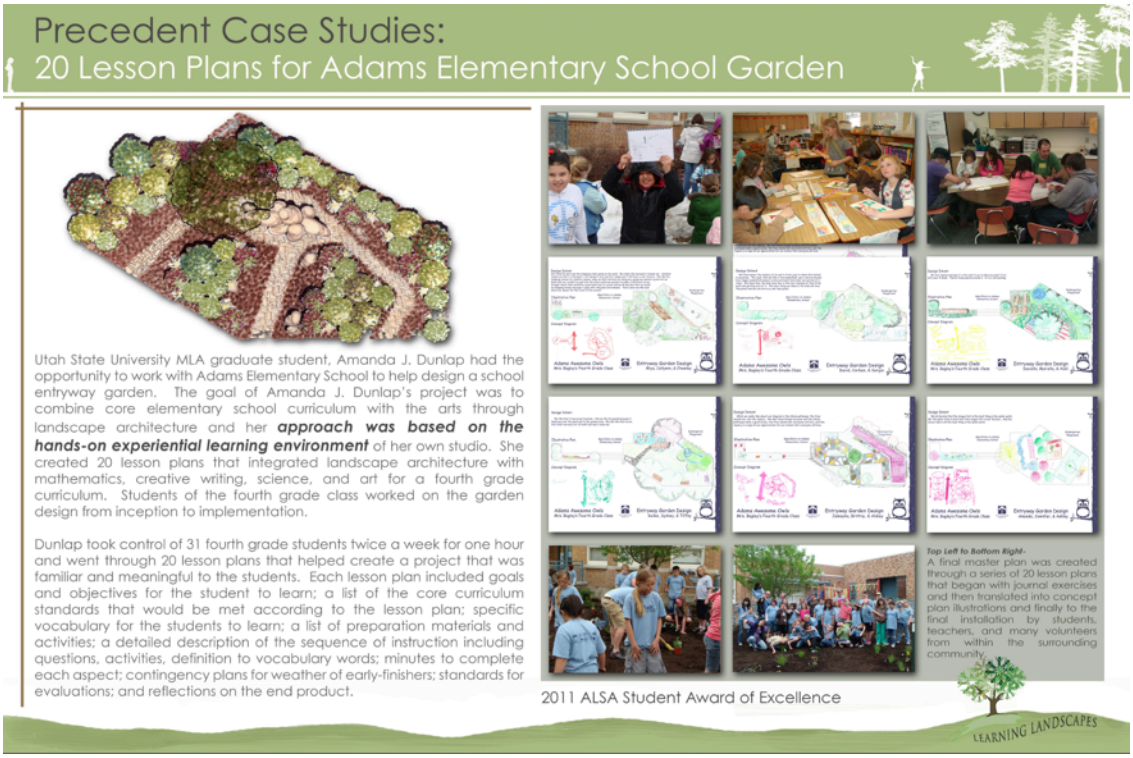


Figure C-6 *Precedent Study Three- Adams Elementary School*

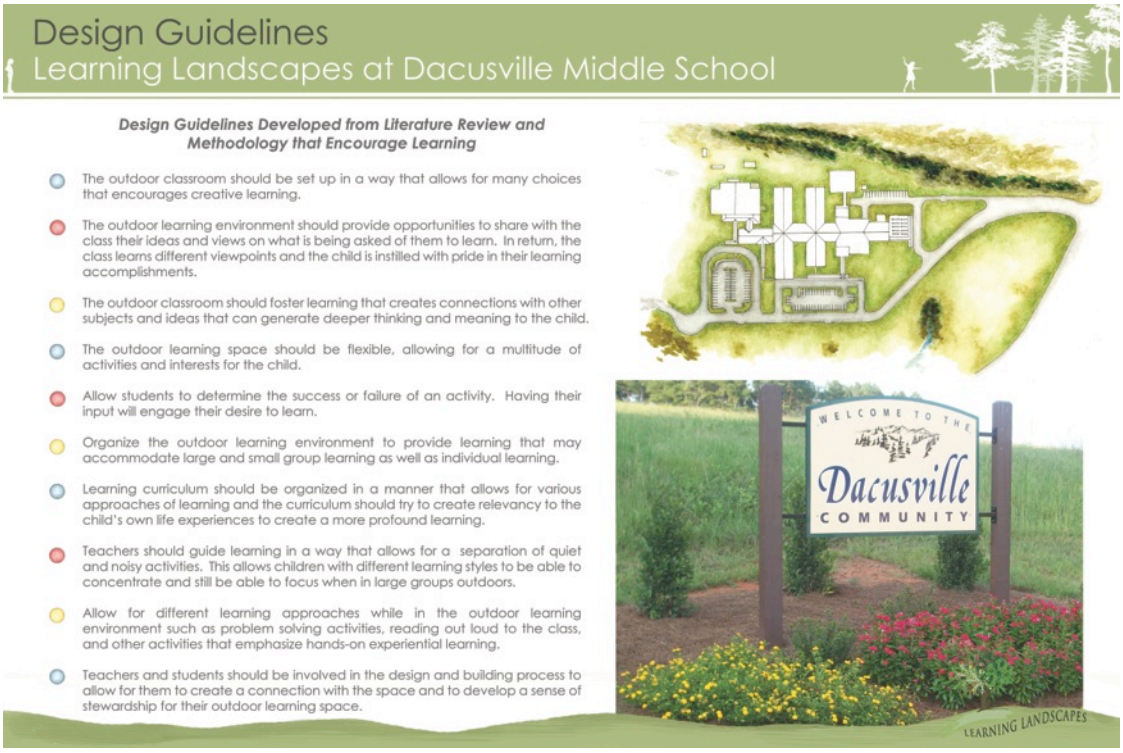


Figure C-7 *Initial Design Guidelines*

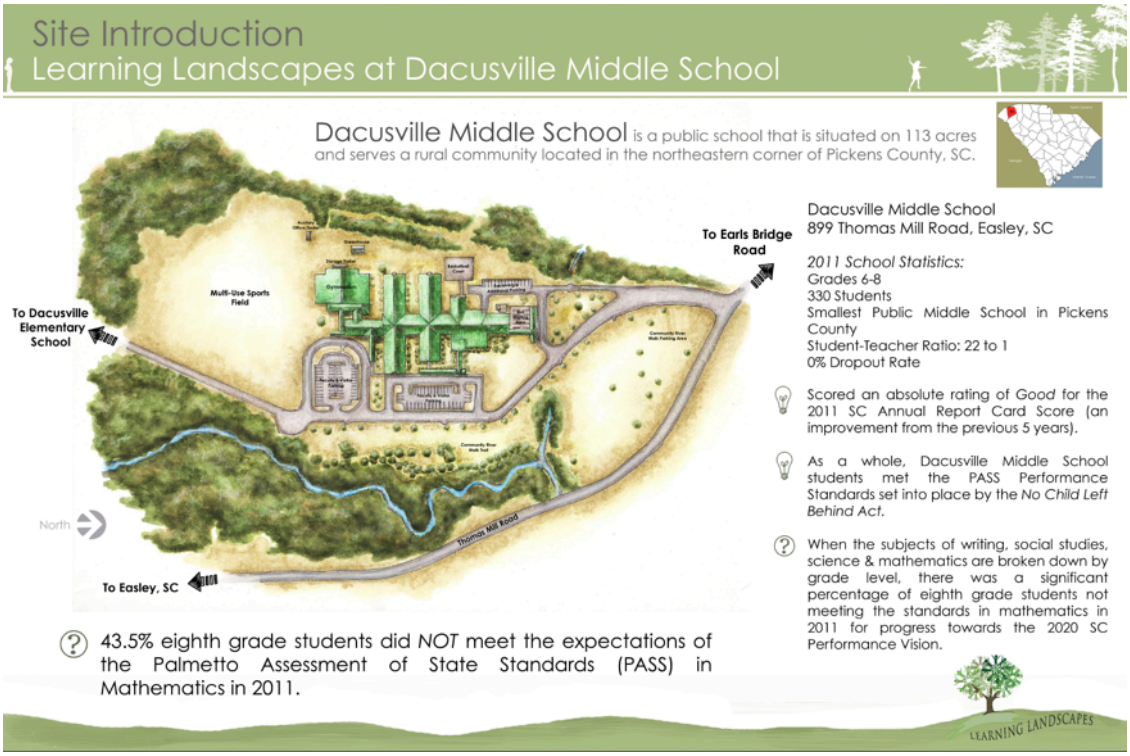


Figure C-8 *Site Introduction*

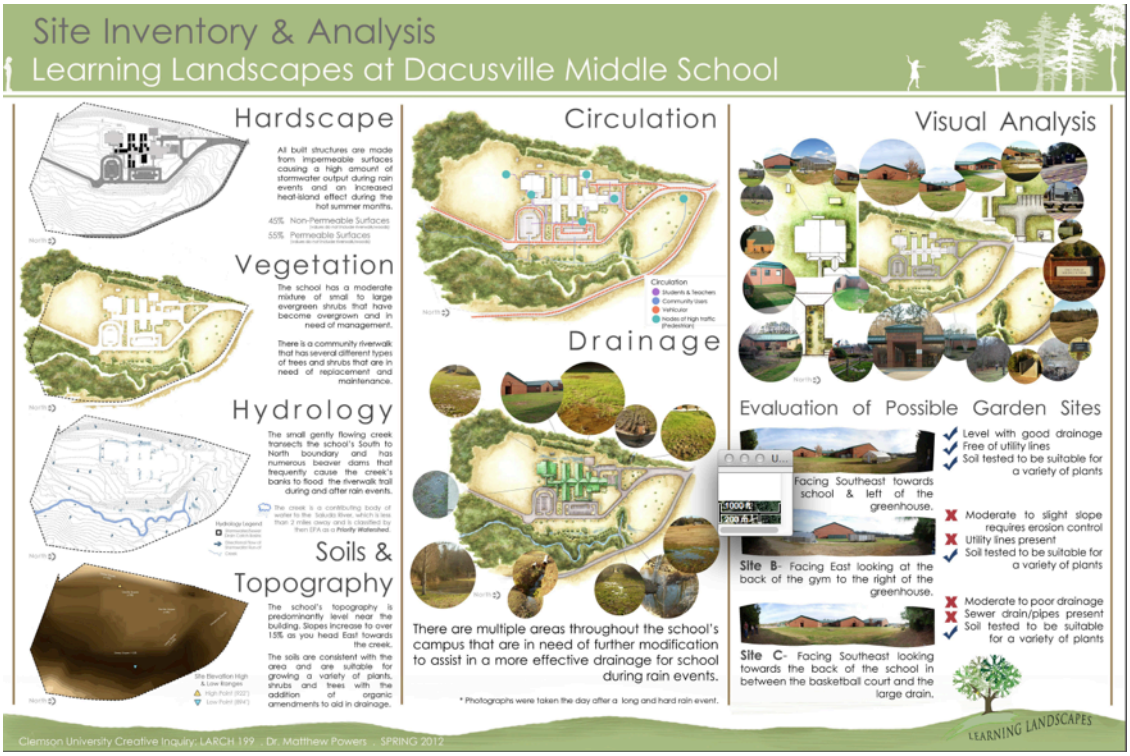


Figure C-9 *Site Inventory and Analysis*

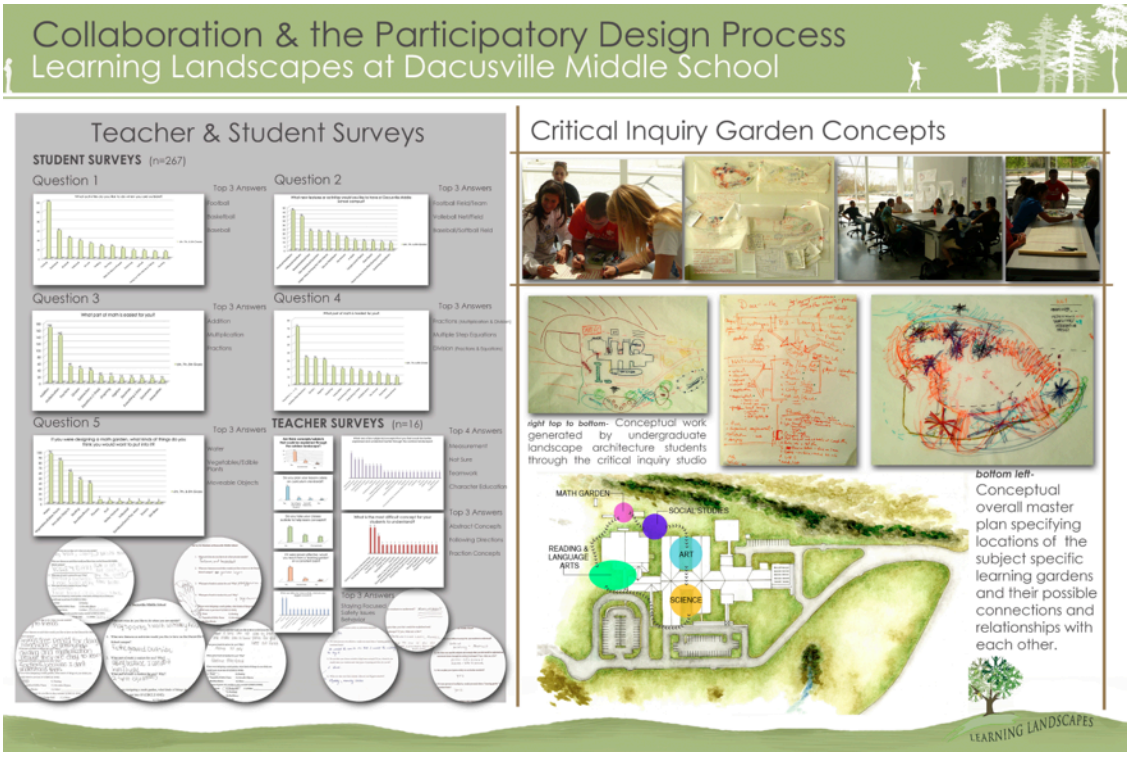


Figure C-10 *Survey Results and Creative Inquiry Design Process*

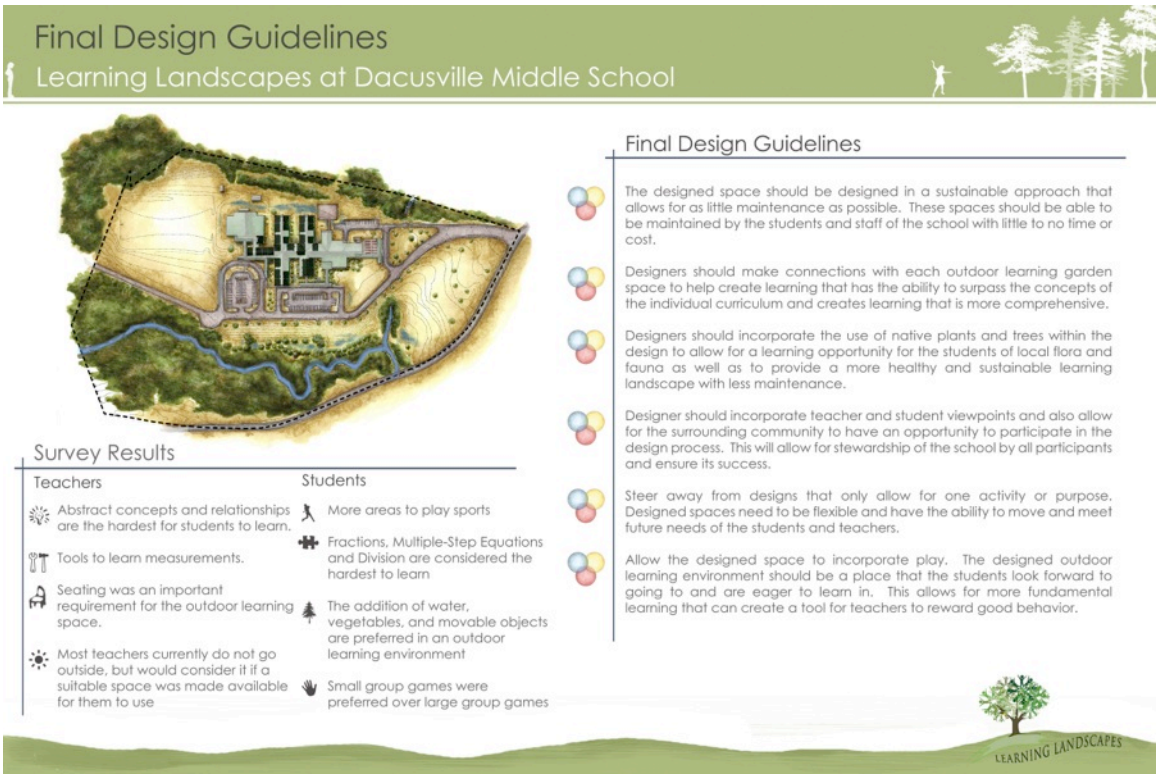


Figure C-11 *Final Design Guidelines*

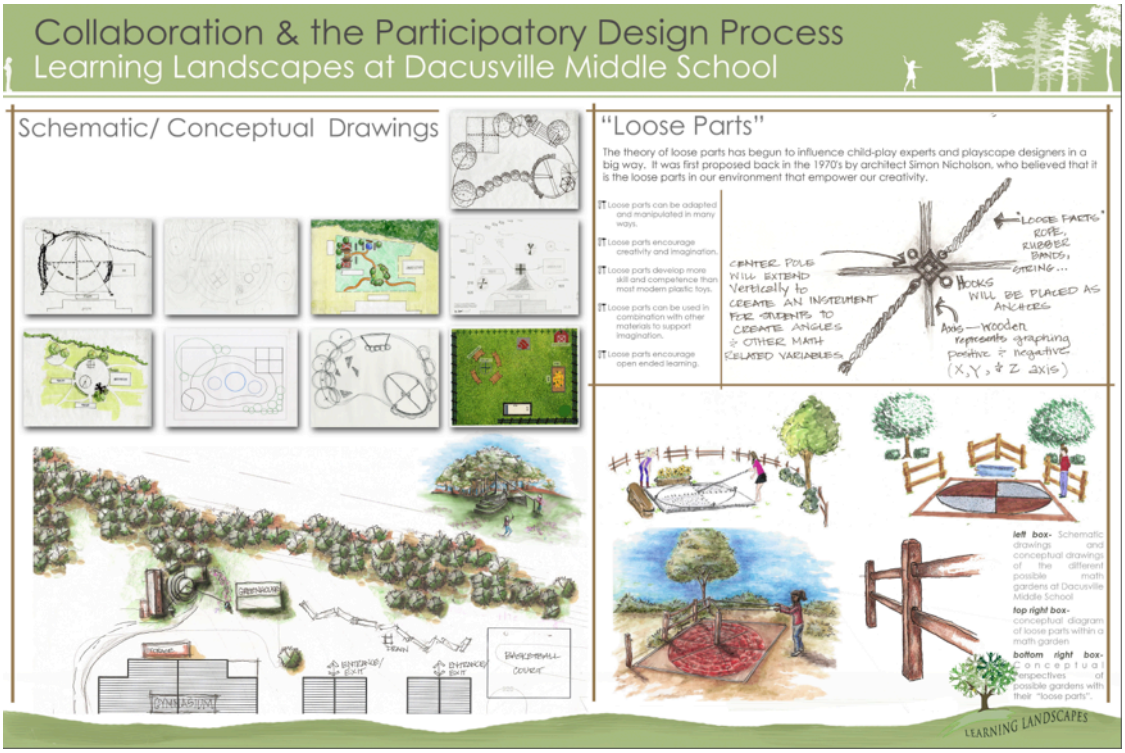


Figure C-12 *Creative Inquiry Design Process*

Figure C-13 *Preliminary Math Garden Design Plan*

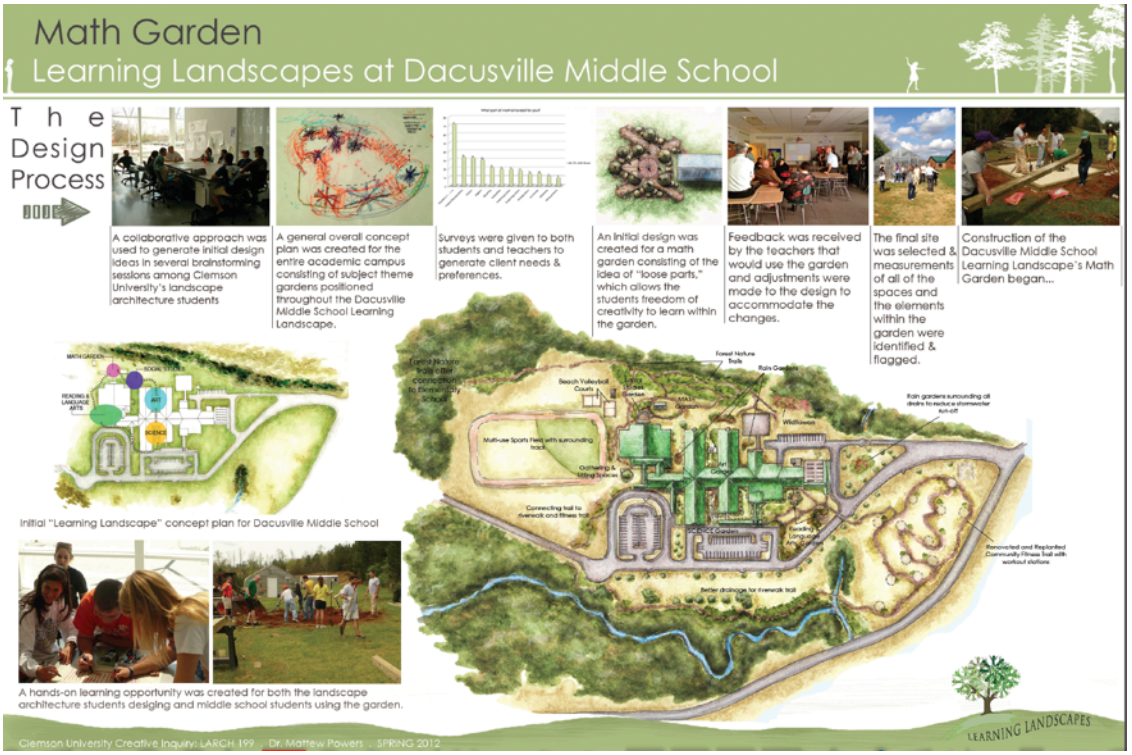


Figure C-14 *Participatory Design Process*

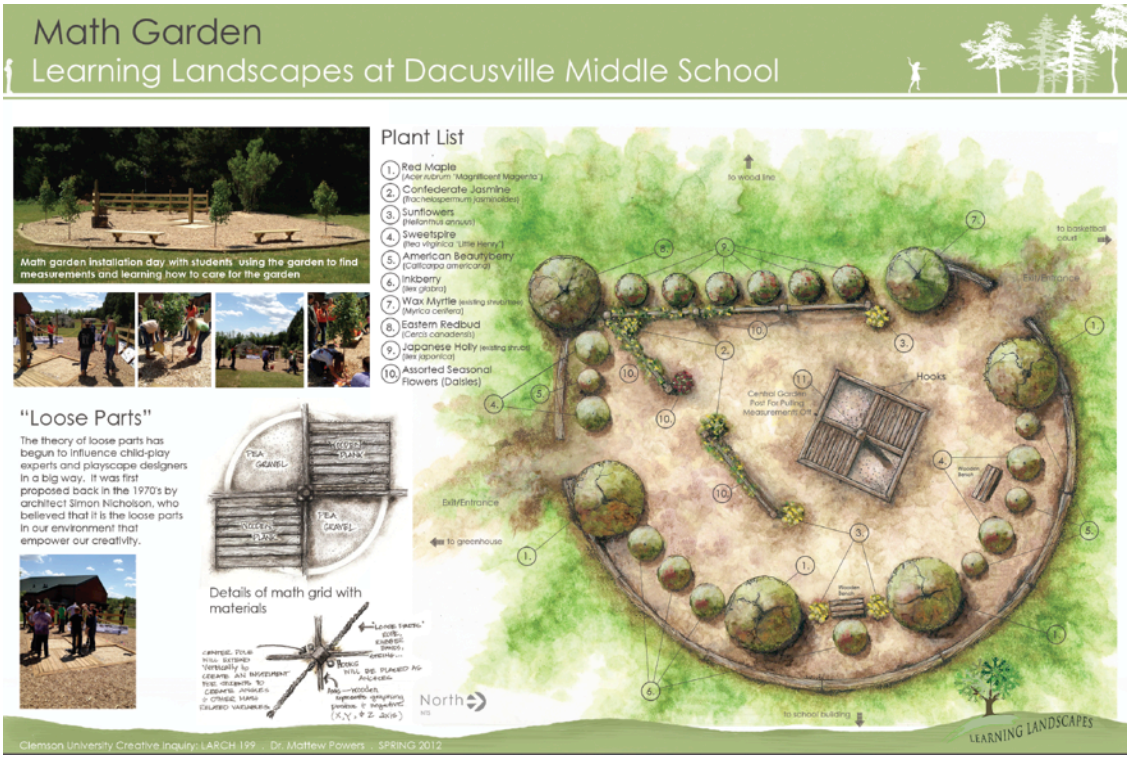


Figure C-15 *Final Math Garden Design Plan*

Figure C-16 *Math Garden Implementation*

Figure C-17 *Final Math Garden Implementation with Plan*

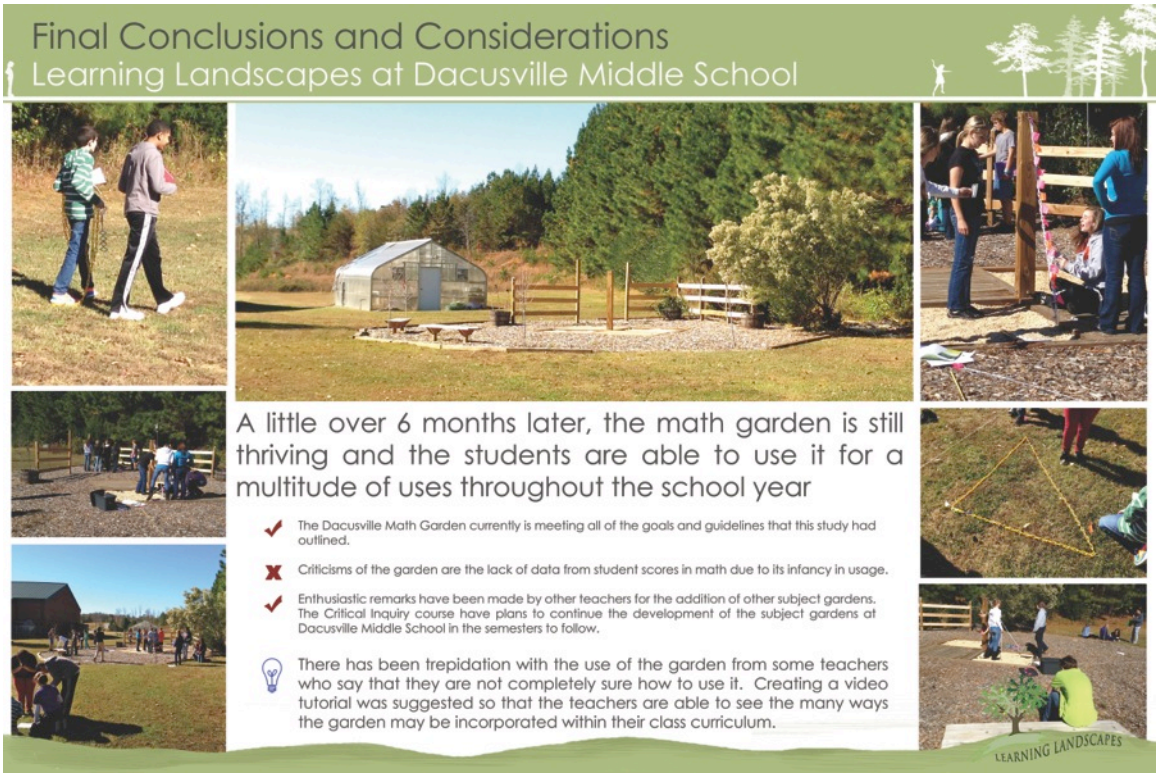


Figure C-18 *Final Thoughts*

*All images were taken and or drawn by Virginia J. Bailey unless otherwise noted.

REFERENCES

Albanese, M.A., and Mitchell, S. 1993. "Problem-based learning: A review of literature on its outcomes and implementation issues." *Academic Medicine* 68: 52-61.

American Society of Landscape Architects. 2011. "ASLA 2011 Student Awards, Adams Elementary School Garden Based on Experiential Learning." Accessed February 25, 2012. http://www.asla.org/2011studentawards/194.html.

American Society of Landscape Architects. 2011. "ASLA 2011 Professional Awards, Manassass Park Elementary School." Accessed February 25, 2012. http://www.asla.org/2011awards/456.html.

American Society of Landscape Architects. 2010. "ASLA 2010 Professional Awards, Nueva School." Accessed February 25, 2012. http://www.asla.org/2010awards/050.html.

Archinnovations.com. 2012. "VMDO Architects- Manassas Park Elementary School + Pre-K." Accessed February 25, 2012. http://www.archinnovations.com/featured-projects/academic/vmdo-architects-manassas-park-elementary-school-and-pre-k/.

Belinda, Christine. 2007. "Loose Parts: What does this mean?" *PennState Better Kid Care.* Last modified on September 14, 2011. http://www.betterkidcare.psu.edu/ENewsletters/ENews0701Jan.html.

Felder, Richard M. 1996. "Matters of Style," *ASEE Prism* (6): 18-23. Accessed January 17, 2012. http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/LS-Prism.htm.

Jones, Elizabeth and Elizabeth Prescott. 1978. *Dimensions of Teaching Learning Environments II. Focus on Day Care*. Pasadena, CA: Pacific Oaks College.

Kolb, David A. 1984. *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice-Hall.

Learning Through Landscapes. 2008. "Ground Notes: Outdoors maths." Accessed March 13, 2012. http://www.slideshare.net/KlausGroenholm/outdoor-math-outdoor-learning-and-play.

Louv, Richard. 2006. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder.* Chapel Hill, NC: Algonquin Books.

Louv, Richard. 2008. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder (Updated and Expanded with 100 Activities for Getting Kids Outside)*. Chapel Hill, NC: Algonquin Books.

Miller, Ashley L. 2010. "Children's Gardens: Design, Participation and Behavior for Environmental Competence." Masters diss., Cornell University.

Moore, R. and Wong, H. 1997. *Natural learning: the life history of an environmental schoolyard: creating environments for rediscovering nature's way of teaching*. Berkley: MIG Communications.

Nicholson, Simon. 1968. "How not to cheat children: the theory of loose parts." *Landscape Architecture* 62: 30-34.

Nicholson, Simon. 1972. "The theory of loose parts: An important principle for design methodology." *Studies in Design Education Craft and Technology* (4) 2: 5-14.

Powers, Matthew N. 2006. "A Study of Self-Regulated Learning in Landscape Architecture Design Studios." PhD diss., Virginia Polytechnic Institute and State University, Accessed January 28, 2012. http://scholar.lib.vt.edu/theses/available/etd-09182006-094841/unrestricted/01AStudyofSRLinLADesignStudios.pdf.

"RSA Animate - Changing Education Paradigms." 2010. YouTube video, 11:41, from a talk given by RSA Animate and Sir Ken Robinson on October 14, 2010. Posted by "theRSAorg." October 14, 2010. http://youtu.be/zDZFcDGpL4U.

Sebba, Rachel. 1986. "Schoolyard Design as an Expression of Educational Principles." *Children's Environments Quarterly* 3(3): 70-75.

Sobel, D. 2004. *Beyond Ecophobia: Reclaiming the Heart in Nature Education*. Great Barrington, MA: The Orion Society and The Myrin Institute.

Spencer, Christopher, and Mark Blades. 2006. *Children and Their Environments: Learning, Using and Designing Spaces.* New York: Cambridge University Press.

Stine, Sharon. 1997. *Landscapes for Learning: creating outdoor environments for children and youth.* Hoboken, NJ: John Wiley and Sons.

Wells, N.M., and Evans, G.W. 2003. "Nearby Nature: A Buffer of Life Stress among Rural Children*." Environment and Behavior* 35(3): 313-318.

Wilson, Ruth. 2008. *Nature and Young Children: Encouraging Creative Play and Learning in Natural Environments*. New York: Routledge.